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ESSENTIALS OF
DISEASES EYE, NOSE AND THROAT

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J H Mules

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BY

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EDWARD JACKSON, A.M., M.D.,
PROFESSOR OF DISEASES OF THE EYE IN THE PHILADELPHIA POLYCLINIC AND COLLEGE FOR GRADUATES IN MEDICINE; MEMBER OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY; FELLOW OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA; FELLOW OF THE AMERICAN ACADEMY OF MEDICINE, ETC., ETC.

PART II.

ESSENTIALS OF DISEASES OF THE NOSE AND THROAT.

BY

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PREFACE TO PART I.

In deciding what to include as Essentials of the Refraction and Diseases of the Eye, the writer has been guided by an acquaintance, gained in post-graduate teaching, with the needs and desires of the mass of medical graduates. For until the time of undergraduate study is extended, and ophthalmology made a compulsory branch of undergraduate instruction, but few will give it much attention during that period. A fair acquaintance with the general principles and facts of medicine and surgery is therefore presumed, and starting from this, the attempt is made to introduce the student to the essentials of this branch. It is also borne in mind that points of anatomy and physiology are given in other volumes of this series, which must be consulted, if their contents be not already stored for mental reference.

In the relative proportions of space assigned to different subjects there are great departures from the average of text-books extant. The capital operations of ophthalmic surgery are but briefly noticed, and subjects of great interest to the advanced special student are passed unmentioned. This is done that the space may be kept for that which is of most importance to the student, who, though well advanced in the study of certain departments of medicine, may be a tyro in this. It is not hoped that all will be satisfied with what can be learned here; but that those who go farther shall find here a good foundation for future progress; and that those who cannot extend their studies in this direction will find the satisfaction of their more urgent needs.

The student cannot be too strongly urged to combine with his reading a study of the laws of refraction, as they can be illustrated with a magnifying glass and piece of card-board; and of the appearance of his own normal eye, with a mirror. And if he can get a single normal fundus to study with the ophthalmoscope every day for a month, he has the best opportunity in the world for beginning the use of that instrument.

EDWARD JACKSON.

215 S. Seventeenth St., Philadelphia, Pa.,
June, 1890.

32079

PREFACE TO PART II.

It is hoped that the following pages will be a sufficient excuse for themselves. It is admitted that, to the learned specialist, the information they contain will appear superficial; but superficial information has its value to a beginner as a foundation for that more profound knowledge which only comes slowly through years of extensive reading, thought, and actual work in the diagnosis and treatment of disease. To the recent graduate in medicine, who wishes to take "a special course in a Nose and Throat dispensary," a little book will probably prove more valuable than a larger volume in enabling him to acquire, in the shortest possible time, those rudiments of Rhinology and Laryngology which are essential in order that he may understand and appreciate that which he sees and hears in the actual work of the dispensary.

It is also thought that this little book may prove useful to the busy general practitioner who, from the force of circumstances, finds himself obliged to treat disease of the nose or throat, and can find quickly here, in a condensed form, the essentials of diagnosis and treatment in any given case. The author has outlined that treatment of each affection that he has found by actual experience most satisfactory, and has simplified the matter as much as possible by mentioning only the few drugs, prescriptions and operative procedures that are essential to the accomplishment of a desired result.

It is supposed that the reader is already familiar with the anatomy and physiology of the upper air passages, and hence lengthy descriptions of anatomical structures and their functions have been omitted, the reader being referred for such to the Question Compends of this series on Anatomy and Physiology, or to the text-books on those subjects.

The author wishes to express his indebtedness to the books of Bosworth, Sajous, Brown, Woakes, and Seiler, and the writings of numerous other authors contained in current medical literature, for aid in the preparation of this little work.

E. Baldwin Gleason.

1204 Walnut St., Philadelphia, Pa.,
June, 1890.

TABLE OF CONTENTS.

PART I.

PAGE

Essentials of Refraction, ... 17
- Prisms, ... 19
- Lenses, ... 19
- Refraction of the Eye, ... 25
- Accommodation, ... 29
- Presbyopia, ... 30
- The Ophthalmoscope, ... 31
- Retinoscopy, ... 37
- Hyperopia, ... 39
- Myopia, ... 41
- Astigmatism, ... 43

Essentials of Diseases of the Eye, ... 49
- Movements of the Eyeball, ... 49
- Methods of Diagnosis and Functional Disorders, ... 61
- Lids, ... 70
- Lacrymal Apparatus, ... 76
- Conjunctiva, ... 79
- Phlyctenular Ophthalmia, ... 87
- Cornea, ... 90
- Sclerotic, ... 99
- Iris, ... 100
- Movements of the Pupil, ... 107
- Ciliary Body and Choroid, ... 109
- Sympathetic Ophthalmia, ... 114
- Vitreous Humor, ... 118
- Crystalline Lens, ... 120
- Glaucoma, ... 128
- Retina, ... 131
- Optic Nerve, ... 135
- Orbit, ... 139
- Drugs and Formulæ, ... 141

PART II.

PAGE
The Laryngoscope, ... 149
  Description, ... 149
  History, ... 149
  Laryngeal Mirror, ... 151
  Reflector, ... 152
  Sources of Light, ... 153
The Art of Laryngoscopy, ... 154
  Optical Law Involved, ... 155
  Relative Position of Patient and Observer, ... 156
  Introduction of the Laryngeal Mirror, ... 156
  Manner of Holding Patient's Tongue, ... 157
  How to Bring Laryngeal Image into View, ... 157
  Temperature of Laryngeal Mirror, how Tested, ... 158
  Obstacles to Laryngoscopy, ... 159
  Auto-Laryngoscopy, ... 160
  Infraglottic Laryngoscopy, ... 161
The Laryngeal Image, ... 161
Rhinology, ... 163
Rhinoscopy, ... 163
  Anterior and Posterior Nares, ... 163
  Anterior Rhinoscopy, ... 163
  Posterior Rhinoscopy, ... 166
  Obstacles to Posterior Rhinoscopy, ... 167
  Posterior Rhinoscopic Image, ... 168
Accessory Instruments, ... 169
  Laryngeal Sound, ... 169
  Cotton Applicator, ... 169
  Atomizers, ... 169
  Air Compressors, ... 169
  Inhalers, ... 170
  Insufflators, ... 170
Examination of Patients, ... 172
Physiology and Pathology of Mucous Membranes and "Catching Cold," 173
  Catarrhal Inflammation of Mucous Membranes, ... 174
  Croupous Inflammation of Mucous Membranes, ... 174
  Diphtheritic Inflammation, ... 175

PAGE
Changes in Secretions of the Upper Respiratory Passages, a Result of Inflammation, ... 175
Modus Operandi of Catching Cold, ... 176
Diseases of the Nasal Cavities, ... 177
Effect on Other Parts of the Body, ... 178
Acute Rhinitis, ... 178
Simple Chronic Rhinitis, ... 179
Hypertrophic Rhinitis, ... 182
Anterior Hypertrophies, ... 183
Posterior Hypertrophies, ... 189
Ecchondroses and Exostoses of the Septum, . . . 191
Atrophic Rhinitis, ... 196
Necrosing Ethmoiditis, ... 200
Coryza Vasomotoria Periodica, ... 204
Nasal Hemorrhage, ... 205
Tumors, ... 207
Polypus, ... 207
Papilloma, ... 208
Sarcoma, ... 208
Carcinoma, ... 209
Syphilitic Rhinitis, ... 210
Diseases of the Septum, ... 212
Deviation of the Septum, ... 212
Hæmatoma of the Septum, ... 214
Abscess of the Septum, ... 215
Submucous Infiltration of the Septum, ... 215
Foreign Bodies in the Nose, ... 216
Diseases of the Pharynx, ... 216
Acute Pharyngitis, ... 217
Chronic Pharyngitis, ... 218
Atrophic Pharyngitis, ... 219
Syphilitic Pharyngitis, ... 220
Retro-pharyngeal Abscess, ... 221
Tumors in the Pharynx, ... 223
Paralysis of the Pharyngeal Muscles, ... 223
Foreign Bodies in the Pharynx, ... 224
The Tonsils, ... 225
Acute Tonsillitis, ... 225
Chronic Inflammation with Hypertrophy of the Tonsils, . 227

PAGE
Elongation of the Uvula, ... 229
The Post-nasal Space or Naso-pharynx, ... 230
    Adenoid Vegetations or Hypertrophy of the Pharyngeal Tonsil, ... 230
Diseases of the Larynx, ... 233
    Anæmia of the Larynx, ... 233
    Hyperæmia of the Larynx, ... 233
    Acute Laryngitis, ... 234
    Subacute Laryngitis, ... 236
    Chronic Laryngitis, ... 236
    Laryngitis Sicca, ... 238
    Inflammation of the Submucous Tissue of the Larynx, . 238
    Laryngitis Syphilitica, ... 241
    Laryngitis Phthisica, ... 243
    Laryngeal Tumors, ... 245
    Foreign Bodies in the Larynx, ... 246
    Laryngeal Neuroses, ... 247
    Adductor Paralysis, ... 248
    Abductor Paralysis, ... 249
    Paralysis of the Tensors of the Vocal Cords, ... 250
    Formulæ, ... 254
Index to Part I, ... 261
Index to Part II, ... 266

ESSENTIALS OF REFRACTION.

What is the optical function of the eyeball?

To support the sensitive retina in such a position that it shall receive impressions made by the light focused or assorted by the dioptric media, while other light is excluded from it.

What are the dioptric media of the eye?

A dioptric medium is any transparent substance, any substance through which light can pass. Those of the eye are the cornea, aqueous humor, crystalline lens, and vitreous humor.

What is the index of refraction of a transparent substance?

It is the number indicating the relative length of time that it takes light to travel a given distance in that substance. Light travels faster in some transparent substances than in others. It travels fastest in a vacuum, but very nearly as fast in air. If we take the time required to travel a certain distance in air as one, the time required to travel the same distance in other transparent media, or the index of refraction of these media, would be as follows:—

Water, the cornea, or the aqueous or vitreous humors,	1.33
The crystalline lens,	1.45
Crown glass, used for spectacles,	1.53
Rock crystal, "pebble,"	1.56
Flint glass,	1.70
Diamond,	2.60

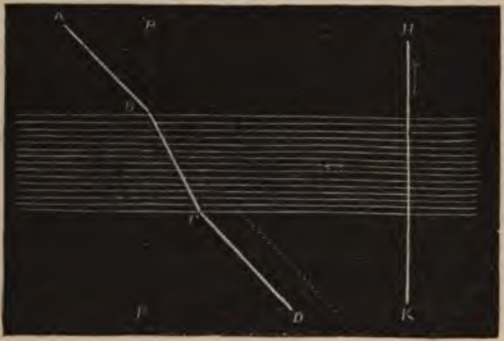
What is a dioptric surface?

Any smooth surface separating transparent substances having different indexes of refraction is a dioptric surface.

What is the refraction of light?

The change in the direction of its movement, that occurs whenever it passes obliquely through a dioptric surface. In Fig. 1, A B represents a ray of light piercing obliquely the dioptric surface of a piece of glass at B, and at that point bent from its direction to the direction B C. At C again it passes obliquely through the other surface, and is bent in the other direction. When a ray pierces a dioptric surface perpendicularly, as the ray H K, it is not refracted. When it passes obliquely from a less refractive to a more refractive medium, it is bent toward the perpendicular P P. When it passes obliquely from a more refractive to a less refractive medium it is bent from the perpendicular. The extent to which light is refracted depends on the obliquity with which it strikes the dioptric surface, and on the difference between the index of refraction of the substance from which it passes and the index of refraction of the substance to which it passes.

FIG. 1.



How is light refracted when it passes through a piece of glass with parallel surfaces?

On entering the glass it is bent toward the perpendicular, but on leaving the glass it is bent, to an equal extent, from the perpendicular, so that its direction after leaving the glass is parallel to its direction before entering it. (See Fig. 1.)

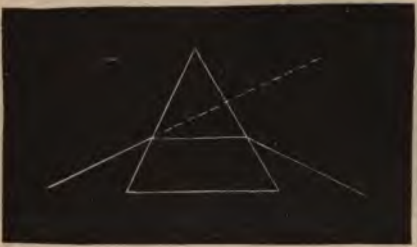
What is a prism?

It is a portion of some transparent medium, for our purposes glass, bounded by plane surfaces that are inclined to one another. The inclined surfaces are called the *sides* of the prism, the angle at which the sides come together is the *refracting angle*, the part of the prism opposite the refracting angle is its *base*.

How is light refracted by passing through a prism?

It is always refracted toward the base of the prism. (See Fig. 2.) The ray is bent toward the perpendicular where it enters the prism, and after passing through the glass, is bent from the perpendicular on passing out. But in both instances it is bent toward the base of the prism.

FIG. 2.



What determines the strength of a prism?

The size of its refracting angle, and the difference between the index of refraction of the glass of which it is made and the index of refraction of the air around it. A prism is said to be strong when it turns the light very much from its original course, and weak when it changes its direction but little.

How are prisms numbered?

In the old system, still in common use, by the number of degrees in the refracting angle; in the new system, by the deviation they cause in the direction of the rays passing through them.

What is a spherical lens?

A portion of a dioptric medium bounded by smooth surfaces, one or both of which are spherical. The word lens, where used alone, is to be taken as meaning spherical lens, unless otherwise indicated.

What is a convex lens?

One that is thickest at the centre. It is indicated by the sign +.

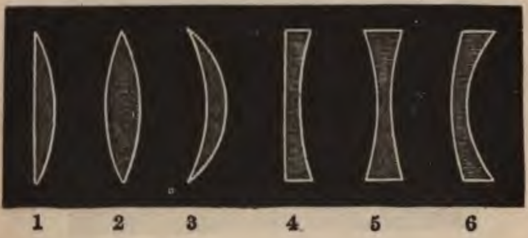
What is a concave lens?

One that is thinnest at the centre. It is indicated by the sign —.

What are the different kinds of convex and concave lenses?

1. Plano-convex, plane one side, convex the other.
2. Double or bi-convex, both sides convex,
3. Concavo-convex, one side concave, the other more convex.

FIG. 3.



4. Plano-concave, one side plane, the other concave.
5. Double or bi-concave, both sides concave.
6. Convexo-concave, one side convex, the other more concave.

3 and 6 are also known as *periscopic* or *meniscus* lenses. These different forms are shown in Fig. 3, the first three being convex, the last three concave.

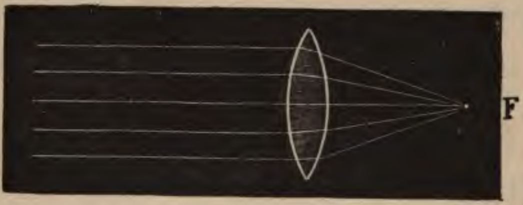
What is the optical centre of a lens?

The point at which the opposite surfaces of the lens are parallel. A lens may be regarded as made up of a series of prisms, which are weakest nearest to the optical centre, and increase in strength as you go from the optical centre. In the convex lens these prisms are placed with their bases toward the optical centre; while in the concave lens they have their bases turned from the optical centre.

How does a convex lens refract the light passing through it?

The optical centre, acting as a glass plate with parallel sides, does not change the direction of the rays that pass through it. The rays that pass near the optical centre, being affected as by weak prisms with the base toward the optical centre, are turned a little toward the centre. Those rays piercing the prism somewhat farther from the optical centre encounter a somewhat stronger prism with its base turned the same way, and are, therefore, more decidedly bent toward the centre. Those still farther removed from the central ray, passing where the lens acts as a still stronger prism are bent yet more toward the central ray. And so on throughout the lens, the farther a ray is from the centre the more it is turned toward the central ray. Hence the rays from all parts of the lens are so turned in as to intersect the central ray some distance back of the lens. Fig. 4 illustrates the effect of a convex lens on parallel rays of light falling upon it. They are all made to intersect the central ray at F. If, however, the light starts from the point F, and falls upon the lens, the central ray, as before, is not refracted, while the others are all bent toward it in such a way that after passing through the lens they will all be parallel. The rays are just as much refracted whichever direction they pass through the lens.

FIG. 4.



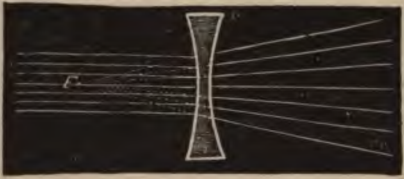
What is a real focus?

It is a point at which the rays that have all started from the same point are brought together again, as by the action of a convex lens. When, as in Fig. 4, the rays which fall upon the lens are parallel, they are regarded as all coming from one point, which is situated at an infinite distance. This point at which the lens brings parallel rays to a focus is called the *principal focus* of the lens. When we speak of the focus of a lens without any qualifying word it is to be understood that the principal focus is meant.

How does a concave lens refract light?

The ray passing through the optical centre is not refracted. The other rays are all turned from it. The concave lens is also to be regarded as a series of prisms, the weakest near the centre the strongest farthest removed from the centre. But in this case the prisms have their bases all turned from the centre, and the effect is to scatter the light, not to concentrate it. In Fig. 5 the effect of the concave lens is shown. After passing through the lens the rays diverge as though they had originally started from the point F.

FIG. 5.



What is a virtual focus?

Such a point, from which rays appear to be diverging after passing through a lens, is called a virtual focus. It is a point from which rays appear to diverge, that in reality start from some other point. When rays previously parallel are refracted by a concave lens, the point from which they appear subsequently to diverge is a *principal focus* of the lens. Thus F is the principal focus of the lens in Fig. 5.

What is the focal distance of a lens?

The distance from a lens to its focus. It is also called the *focal length* of the lens. The distance from a lens to its principal focus is its *principal focal distance*, or length; and this is what is generally meant when the focal distance of a lens is mentioned.

What determines the strength of a lens?

A "strong" lens is one that can make a great change in the direction of the rays passing through it, and bring them quickly to a focus. The farther the rays have to travel after passing through the lens before they come to a focus, the weaker the lens; the strength of a lens is inversely as its focal distance. Now, in order that the rays may be quickly turned into the focus, the inclination of the sides of the lens to each other, or from each other, must increase rapidly as you go from the optical centre toward the margin. The strength of a lens therefore depends on the curvature of its surfaces. It also depends on the differences between the index of refraction of the substance of which the lens is made and the index of refraction of the air.

How are lenses numbered by the inch system?

Each lens is designated by the number of inches in the radius of curvature of its equally curved surfaces if it is a bi-convex or bi-concave; or if it is of one of the other shapes it is given the number of the bi-convex or bi-concave lens of the same strength. Formerly most trial sets were made in Paris and given the number of the Paris inches in their radii of curvature. And it happened that the glass of which they were made had such an index of refraction as to make the focal distance of the lens in English inches about the same as the radius of curvature in Paris inches. Hence the number of the lens has very generally been taken as indicating the number of inches in its focal distance.

How do you express the strength of a lens numbered on the old or inch system?

By a common fraction, in which the numerator is 1 and the denominator is the number of the lens; that is, the strength of the lens is just the inverse, or reciprocal of the number which expresses its focal distance. It will be noticed that the different fractions expressing the strengths of different lenses will all have different denominators. Hence in adding or subtracting these lenses whenever they were to be combined one with another, we always had to work with fractions that required to be reduced to a common denominator.

How are lenses numbered by the new metric, or dioptric system?

A lens that brings parallel rays to a focus at a distance of one metre is taken as the unit and called a one dioptre lens, written 1 D. A lense twice as strong is called the two dioptre lens, one three times as strong, a 3 D. lens, and so on; the number of the lens expressing its strength. For lenses weaker than one dioptre, and for those intermediate between whole dioptres, decimal fractions are used, as 0.50 D., or 2.75 D. Hence when lenses numbered on this system are combined we have only to do with the addition, or subtraction of whole numbers and decimal fractions.

How do the numbers given to the same lens by these different systems of numbering compare with one another?

In the following table the first column gives the number of the lens according to the dioptric system, the second column gives the focal distance in English inches of its exact equivalent, and the third column gives the nearest equivalent, as inch lenses are commonly made.

DIOPTRES.	FOCAL DIST.	OLD NO.	DIOPTRES.	FOCAL DIST.	OLD NO.
0.25	157.5	144	6.	6.6	6½
0.50	78 7	72	7.	5.6	5½
0.75	52.5	48	8.	4.9	5
1.	39.4	36	9.	4.4	4½
1.25	31.65	30	10.	3.9	4
1.50	26.2	24	11.	3.6	3½
1.75	22.5	22	12.	3.3	3¼
2.	19.7	20	13.	3.	3
2.25	17.5	18	14.	2.8	2¾
2.50	15.7	16	15.	2.6	
2.75	14.3	14	16.	2.4	2½
3.	13.1	12	17.	2.3	
3.50	11.2	11	18.	2.2	2¼
4.	9.8	10	19.	2.1	
4.50	8.7	9	20.	2.	2
5.	7.9	8	25.	1.5	
5.50	7.2	7	30.	1.3	

What is the trial-set?

A collection of glasses for testing the optical conditions of the eye. It includes pairs of the convex and concave lenses given in the preceding table, the same numbers of cylindrical lenses up to 6 D., prisms, solid disk to exclude one eye when testing the other, a pinhole and stenopaic disks, colored glasses, and a trial frame in which any of these may be placed before the eye. Sets containing fewer lenses can be made to answer for any case, by combining two or more lenses together.

How would you ascertain the strength of any lens?

By finding what lens in the trial-set exactly neutralized it. This would be a lens of the opposite kind but having the same number as the lens tested. When a convex lens is held a little before the eye, and moved slowly up and down or from side to side, distant objects seen through the lens appear to move in the opposite direction. When the same thing is done with a concave lens, the distant objects appear to move in the same direction as the lens. When, however, we place together a convex and a concave lens of equal strength, and move them thus, the objects seen through them appear to remain fixed in their proper position, just as though seen through a piece of plane glass. The absence of motion proves that the lenses exactly neutralize.

Refraction of the Eye.

What are the dioptric surfaces of the eye?

The anterior surface of the cornea, the anterior surface of the lens, and the posterior surface of the lens. Light reaches the retina only after passing through them.

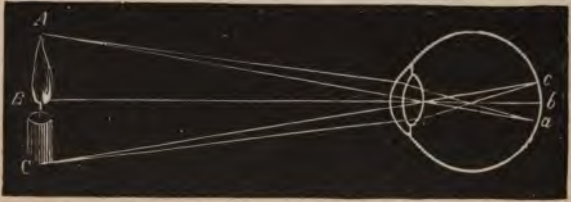
How do these surfaces refract light?

As so many convex lenses, and their total effect is that of a very strong convex lens. One ray falling perpendicularly on the cornea is not refracted, while all the other rays coming from the same point are bent toward it, and made to intersect it at a focus a certain distance back of the cornea.

What is the effect of this focusing of the light?

All the light that enters the eye from any one point outside it is collected to a single point within it. Thus in Fig. 6 the rays coming from the point *A* are all focused at the point *a* within the eye. In the same way all the rays coming from the point *B* are focused at the point *b*, and the rays from *C* at *c*. The same is true for any number of points situated between these, or on either side of them. Now if the sensitive retina, on which the impressions of light are made, be so situated that these foci fall exactly upon it, each point of retina will receive all the light from one point outside the eye, and from that point alone. It will therefore transmit to the brain a distinct impression made by that particular point. And the brain thus receiving separate messages from each point of surrounding objects, is able to discriminate between the different ones presented to the eye at the same time. If, however, the retina be so situated that the rays are not perfectly focused upon it, it receives impressions that are not perfectly assorted, but run into each other.

FIG. 6.



(*After Hartridge.*)

What determines the acuteness of vision?

The sensitiveness of the retina and connected nervous apparatus, and the perfection of the focusing of the light on the retina. When one of these is constant, the acuteness of vision becomes the measure of the other.

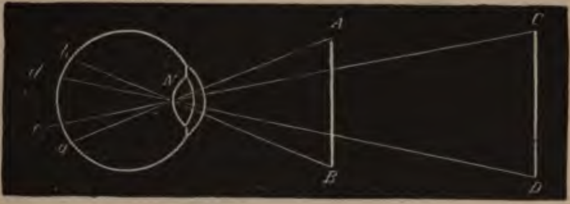
How do you ascertain and record the acuteness of vision?

The size of the image on the retina is proportional to the size, and inversely proportional to the distance of the object looked at. This may be understood from an examination of Fig. 7, in which *A B* and *C D* represent objects of the same size at different distances from the eye. Series of test-type of different sizes are prepared, and each size is marked with the distance it should be seen by a perfect eye, in good light. We use these by finding what is the smallest type that can be seen at a certain distance; and then by a fraction, of which the distance at which the type is seen is the numerator, and the distance it would be seen by a perfect eye is the denominator, we express the acuteness of vision. Thus, if the types are seen at fifteen feet, and the smallest that can be made out at that distance is that which should be visible at forty feet, the acuteness of vision is $\frac{15}{40}$.

When do we have divergent, parallel, or convergent rays?

These terms, as we use them, always refer to rays coming from the same point, and rays always diverge from a luminous point in every possible direction, and continue in their divergent course so long as no change occurs in the medium through which they pass, so that in nature we encounter only divergent rays. The more distant the point from which they come, the less divergent will be the rays that fall upon any given area, as the surface of a lens or the pupil of the eye. Rays coming from an infinite distance would be strictly parallel; but if they come from a distance of fifteen or twenty feet, or over, they are so nearly parallel that we may call them parallel without serious error, and shall hereafter speak of them as parallel rays. Rays are rendered convergent by passing through a convex lens, or by being reflected by a concave mirror.

FIG. 7.



What is the refraction of the eye?

Its optical state with reference to parallel rays when the crystalline lens is least convex or weakest, as it is when under the influence of atropia, or as it would be immediately after death.

What is the accommodation of the eye?

The power of changing the optical state of the eye by making the crystalline lens more convex, causing it to act as a more convex or stronger convex lens, and thus increasing the total refractive power of the eye.

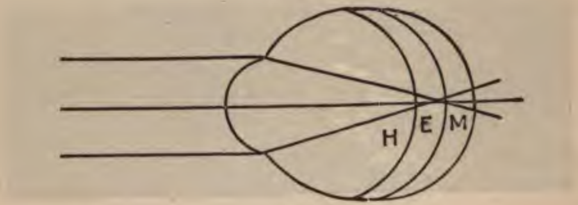
When is an eye emmetropic?

When its retina is just far enough back from the cornea and crystalline lens to have perfectly focused upon it rays that have reached the eye parallel, the accommodation being entirely at rest. This position of the retina is shown in Fig. 8, at E. Emmetropia (proper proportions) is the name given to the state of refraction in such an eye. It is often represented by the abbreviation E.

When is an eye hyperopic?

When its retina is too near the cornea and lens, and the light falls upon it before it is focused, the accommodation being at rest. Such a position of the retina is indicated at H in Fig. 8. The state of refraction in such an eye is called *Hyperopia* or *Hypermetropia*. It is represented by the letter H.

FIG. 8.



When is an eye myopic?

When its retina is too far back from the cornea and lens, so that rays which enter the eye parallel are focused before they reach it. Such a position of the retina is shown at M, Fig. 8. Its state of refraction is *Myopia*, represented by the abbreviation M.

What is ametropia?

This is a general term, including all states of the refraction of the eye that differ from emmetropia. The emmetropic eye is to be regarded as the standard or perfectly formed eye; and all departures of the refraction from the emmetropic standard are spoken of as *errors*, or *anomalies of refraction*.

Why does the eye require the power of accommodation?

Rays enter the eye with different degrees of divergence, proportioned to the nearness of the object from which they come. The more divergent rays need to be turned more from their original course, they require a lens of greater refractive power to focus them. Hence the need to be able to render the crystalline lens more convex when the more divergent rays from near objects are to be focused on the retina.

How is the accommodation of the eye effected?

The crystalline lens is normally elastic, and tends to become spherical in shape; but it is compressed between the anterior and posterior portions of its capsule, the capsule being made tense by the traction of the suspensory ligament of the lens. By contraction of the ciliary muscle the tension is taken off the suspensory ligament and capsule, and the lens thus partially released from its ordinary compression, tends toward the spherical shape, and becomes more convex.

What is the near point?

When the ciliary muscle is contracted to the full extent of its power, the lens becomes the most convex that it ever can, and focuses rays the most divergent that it is ever able to focus on the retina. The point from which these rays diverge is the near point of distinct vision. It is often called the *punctum proximum*, and indicated by the abbreviation *pp*. Rays coming from points beyond *pp*. are focused on the retina by less contraction of the ciliary muscle.

How do you determine the near point?

Take test-type prepared for the purpose, and hold them first at a distance at which they are read most easily, then while the patient continues to read them bring the test progressively nearer to the eye, until he can no longer see them clearly. The nearest point at which they are read is the point desired. In making this test care must be taken that the type are so small as to require perfect focusing in order that they should be seen at this distance, and the patient must be induced to make the effort, and exert his whole accommodative power.

What is the amplitude of the accommodation?

The extent to which the exertion of the full power of the ciliary muscle is able to change the focusing power of the crystalline lens. It is usually expressed in dioptres, and is the equivalent of a convex lens of the same number of dioptres of refractive power, placed just in front of the eye.

What determines the amplitude of accommodation?

The power of the ciliary muscle and the flexibility of the lens.

How is the accommodation affected by age?

From early childhood the lens becomes year by year less flexible, gradually losing its power of becoming more convex upon contraction of the ciliary muscle. After sixty it becomes so rigid that the attempt is no longer made to change its shape, and the muscle atrophies. The following table shows how the amplitude of accommodation diminishes with age, the first column giving the age in years, and the next the accommodation in dioptres, this gives, of course, only an average from which individuals may vary considerably :—

YEARS.	DIOPTRES.	YEARS.	DIOPTRES.
10,	14.	40,	4.5.
15,	12.	45,	3.5.
20,	10.	50,	2.5.
25,	8.5.	55,	1.5.
30,	7.	60,	0.5.
35,	5.5.	65,	0.

What proportion of the accommodation is available for continuous near work?

About two-thirds of the whole. If an effort is made to exert more than this, much of the time, the ciliary muscle and nerves governing it are over-fatigued and symptoms of eye-strain appear.

What is presbyopia?

The diminution of the power of accommodation by age, to such an extent as to interfere with the ordinary use of the eyes for reading, writing, sewing, and similar near work.

When does presbyopia usually occur?

Between forty and fifty years of age. Reading, writing, etc., are ordinarily done at a distance of from twelve to eighteen inches, requiring the use of 2 D. or 3 D. of accommodation; and when the total accommodation has so far diminished that this is more than two-thirds of it, the trouble begins.

What are the symptoms of presbyopia?

One of the first is a tendency to hold reading matter further from the eyes than has previously been the custom. Things requiring particularly accurate vision, as threading a needle, or reading very fine print, can no longer be done, except in a very good light. After the use of the eyes for close work for a time the thing looked at is apt to become dim, and it is necessary to rest the eyes for a little time. Or there is pain or headache after the use of the eyes for near work, or the eyes become congested, or even inflamed, after such work. Such inflammation is often ascribed to "cold."

What is the remedy for presbyopia?

The use of the proper convex lenses for all near work. The lens does a part of the work which would otherwise all devolve on the accommodation. It should be strong enough to render it unnecessary to use over two-thirds of the remaining accommodation.

How often should the glasses be changed in presbyopia?

While the accommodation is still diminishing, they should be changed at least once every two or three years. But after the power of altering the form of the crystalline lens is pretty much lost, as after the age of fifty-five, they may not need changing for a long time.

The Ophthalmoscope.

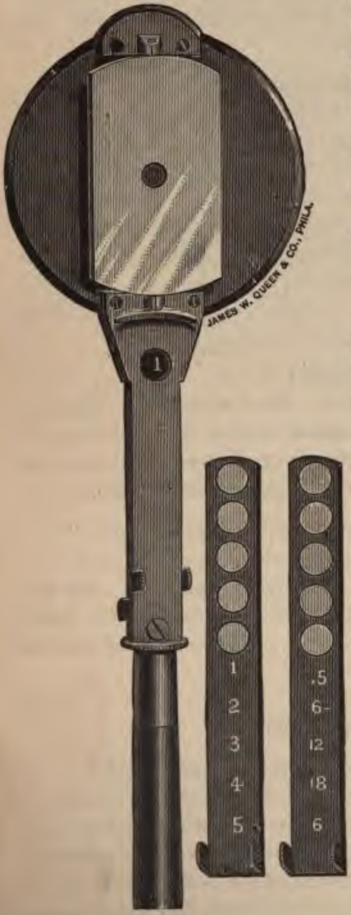
Why does the pupil of the eye ordinarily appear black?

The focusing or assortment of the light that enters the eye allows one part of the retina to be brilliantly lighted up, while another part is in comparative darkness. When one looks into another's eye the part of the retina he might see if it were lit up, is the part that can get light only from the direction of his own pupil, and which therefore is receiving very little light at that time.

What is the ophthalmoscope?

An instrument having a mirror to throw light into the interior of the eye, and a hole in the mirror, through which the observer can look and see an illuminated part of the retina. The mirror is usually concave, so as to concentrate the light in the pupil. The margin of the sight-hole should be carefully blacked, to avoid confusing reflections from it.

FIG. 9.



What is a refraction ophthalmoscope?

One in which a series of convex and concave lenses are placed back of the mirror in such a way that either of them can be brought to the sight-hole, for the measurement of the various forms of ametropia. As it has to be used very close to the eye, it should have the mirror so attached that it can be inclined either to the right or left. It should be possible to use all the lenses without having to take the instrument from the eye to change them.

The form represented in Fig. 9 has been found by the writer most generally convenient and satisfactory. It contains a full series of lenses extending to convex 10 D. and concave 25 D., all available without having to take the instrument from the eye.

What is the direct method of ophthalmoscopic examination?

That in which the observer looks directly at the interior of the eye under observation, very much as one might look at any small object through a strong magnifying glass.

What are the relative position of surgeon and patient for such an examination?

They sit side by side but facing in opposite directions. The lamp is behind the patient, not immediately back of him, but rather to the side of the eye to be examined, that is, in front of the surgeon, so that the light from it shines on the patient's temple, and just touches the tips of the outer lashes. To examine the patient's right eye the surgeon sits on the patient's right, and holds his ophthalmoscope in his own right hand and uses his own right eye; while for the left eye he sits on the patient's left and uses his own left eye and hand. This must be done in order to get near to the eye to be examined. When thus arranged the ophthalmoscope is held so as to reflect the light from the lamp into the patient's pupil while the surgeon looks through the sight-hole. The area of light reflected on the patient's face will have the shape of the ophthalmoscope mirror, with a dark spot in the centre corresponding to the sight-hole. This gap, caused by the sight-hole, must be made to fall about on the pupil, before the interior of the eye will be well lit up.

What is the fundus reflex?

A general red glare that seems to fill the pupil on first throwing the light into an eye with the ophthalmoscope.

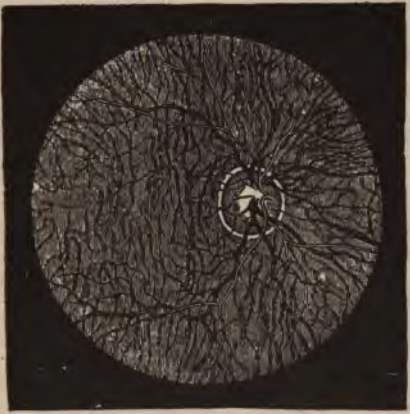
What can be seen with the ophthalmoscope?

The transparent media of the eye are normally as invisible as the air. The retina, too, is normally almost perfectly transparent, and in eyes with a light fundus is also quite invisible. In eyes with a very dark choroid it appears like a faint gray veil. The layer of pigment epithelium, belonging with the retina, though often spoken of as part of the choroid, determines whether the general hue of the fundus shall be light or dark, by the amount of pigment it contains; and also to what extent the choroid back of it shall be visible. When there is little pigment in this membrane, the larger choroidal vessels are seen through it, forming a network with interspaces that are light if the choroid also is deficient in pigment, or dark when it is more deeply pigmented. If the retinal pigment and that of the choroid are both quite lacking, one sees the white sclera.

What is the optic disk?

It is the ocular end of the optic nerve. Sometimes it protrudes a little into the vitreous humor. It is often called the optic papilla. Generally there is in its centre a depression known as a *physiological cup*, or cupping of the disk. This is the whitest part of the disk. Around it is a pinker zone. The whole disk is lighter colored than the rest of the fundus, approaching it in color in very light eyes; but contrasting very sharply in eyes that are darkly pigmented. Around the disk there is generally an incomplete ring of darker brown color, due to an accumulation of pigment in the margin of the choroidal foramen through which the nerve fibres are admitted to spread out on the retina.

FIG. 10.



Fundus of an eye containing little pigment, choroidal vessels visible. (*Wecker*.)

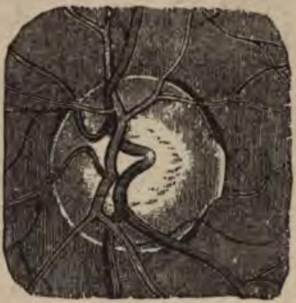
Describe the appearance of the retinal vessels.

They are darker red than the general fundus, the veins being darker than the arteries, and of a more crimson hue. They come into view a little to the nasal side of the centre of the optic disk, generally as several branches; and the larger branches pass upward and downward, the majority of them curving toward the temporal side of the retina.

How do you measure the refraction of the eye with the ophthalmoscope?

Looking into the eye by the direct method, the different lenses are one after another tried before the sight-hole until one is found which makes the details of the fundus distinct, when neither the surgeon nor the patient are using any accommodation. In doing this it is best to look at some of the fine vessels to the temporal side of the disk, between the disk and the macula.

FIG. 11.



Normal optic disk of the left eye. (*After Jaeger.*)

How are the patient and surgeon to secure relaxation of the accommodation?

The patient must look off, and allow his gaze to rest on some dark curtain or shadow where the use of his accommodation would not enable him to see anything distinctly. On this account the room for such an examination should not be very small, and should be thoroughly darkened. The surgeon, too, must look as though at some distant object. The power of doing this whenever desired is only to be acquired by much practice.

If more than one lens renders the details of the fundus clear, which is to be chosen?

The strongest convex, or the weakest concave, is the nearest right. If the observer's eye is emmetropic, or his ametropia corrected, this is the glass the patient needs; otherwise allowance must be made for the observer's ametropia.

What is the indirect method of ophthalmoscopic examination?

The surgeon keeps his eye a foot or more away from the patient's eye, in front of which he holds a strong convex lens. The lamp is placed back of the patient, but the surgeon can examine both eyes while sitting on one side of the patient, or directly in front of him. When the retina has been lit up by the light reflected into the eye by the mirror, the light which emerges from it is focused by the convex lens, so that it forms an inverted aerial image in front of the lens, and it is at this inverted image that the surgeon looks, as in the direct method he looked at the retina itself.

What are the respective merits of the direct and indirect methods?

The former shows the parts in their true relative positions, gives a more magnified view of the retina, allows the estimation of the state of refraction, and by differences of refraction, permits us to measure the relative protrusion (as in neuritis), or recession (as in glaucoma), of various parts of the fundus. The indirect method merely allows us to see a larger part of the interior of the eye at one glance, the image being less magnified; but it does not compel one to get so near the patient's face. It is less valuable, and is coming to be less used than the direct method.

When can the inverted image of the fundus be seen without any convex lens?

When the eye is myopic, the rays from the retina are focused in front of the eye, at the distance from which rays would be focused on the retina. At this distance, therefore, an inverted image of the fundus is formed. Thus, in Fig. 12, the image of A is formed at *a*, while that of B is formed at *b*; and by drawing back from the eye beyond this point this inverted image can be seen. When the eye is highly myopic, it is easy to examine the inverted image thus formed, without any convex lens.

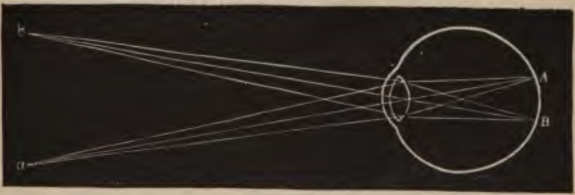
What is the point of reversal?

It is the point at which this inverted image is formed. Closer to the eye than this its fundus is seen erect; beyond this the inverted image is seen.

What is the shadow test or retinoscopy?

A method of finding the point of reversal by throwing light into the eye from a mirror, and by turning the mirror, and so causing the light to move about in the eye; and then knowing the direction of its real motion, and noticing the direction of its apparent motion, ascertaining whether the erect or the inverted image is seen. By trying this at different distances and with different lenses, we find out where the reversal occurs, and this point of reversal being the point for which the eye is focused, gives us the amount of myopia.

FIG. 12.



How does the light really move, with the plane mirror?

With the mirror; that is, in the same direction as the light area that moves across the face. This is true whether the eye is myopic, or hyperopic, or emmetropic.

How does the light in the pupil appear to move in myopia?

Closer to the eye than the point of reversal, it appears to move with the light on the face. Beyond the point of reversal, in the opposite direction from that of the light on the face. At the point of reversal the illumination becomes very faint in the centre of the pupil, and destitute of motion, although the edge of the pupil may present a bright reflex, with a very distinct motion.

How do you determine the amount of myopia?

The point of reversal is the point for which the eye is focused. Its distance from the eye, which can be measured by the metre-stick or tape, is the focal distance of the lens required to correct the myopia. Thus, if the reversal occur at a half-metre, there are 2 D. of myopia; if at one-seventh of a metre, 7 D. If we find that the myopia is high, it is best to correct part of it by placing a concave lens before the eye, then measure the remaining M., and add it to the strength of the lens used for the total M.

How does the light in the pupil appear to move in hyperopia?

Always with the light on the face; because the rays that come out of a hyperopic eye do not converge, and are not focused at any distance in front of the eye.

How do you determine the amount of hyperopia?

Place in front of the eye a convex lens that is strong enough to over-correct the hyperopia, and measure how much myopia this lens causes; then subtracting this from the whole strength of the lens, the remainder will be the amount of hyperopia.

How do you determine the presence of emmetropia?

The rays emerging from the eye parallel, do not come to a focus, so that at all distances the light in the pupil appears to move with the light on the face. But on placing a convex lens before the eye, the point of reversal is found to coincide with the principal focus of the lens, the amount of myopia caused by the lens being just equal to its strength.

How does the light move when the concave mirror is used?

The light area on the retina really moves in the direction opposite to that of the light on the face. Its apparent motion in the pupil is therefore just the opposite of the apparent motion with the plane mirror under similar circumstances. Thus, in myopia, from beyond the point of reversal the apparent motion is with that of the light on the face; while in hyperopia and emmetropia, and in myopia when closer to the eye than the point of reversal, the apparent motion is against that of the light on the face.

How else is the shadow-test modified by the use of the concave mirror?

It is not practicable with the concave mirror to vary the distance from the eye under observation. Hence a certain distance is chosen, usually about one metre, and by trying different glasses the point of reversal is brought to this distance. The glass that does this leaves the eye with one dioptre of myopia; and to get the glass which will just correct the ametropia present and give perfect distant vision, the glass used must have one dioptre added to its strength if it is concave, or subtracted if it is convex.

What are the conditions of accuracy with the shadow-test?

The pupil must be dilated, the room thoroughly darkened, the source of light brilliant but small (a lamp-flame enclosed by an opaque metal chimney, in the side of which is a circular opening ten millimetres in diameter, is a good source), the edge of the sight-hole in the mirror thoroughly blackened, and a lens before the eye that will bring the point of reversal to a distance of one or two metres from the eye.

Hyperopia.

What are the advantages of an emmetropic eye?

It can see all distant objects clearly without any exertion of its powers of accommodation; and has all of its accommodative power available for the focusing of light from close objects.

What are the disadvantages of the hyperopic eye?

It cannot in a state of rest see clearly at any distance. For even parallel rays it must use some of its power of accommodation; and therefore has so much less focusing power left for overcoming the divergence of rays from near objects.

What is the absolute hyperopia?

When the H. is greater than the amplitude of accommodation, the accommodation is not able to correct all of it. The part that remains uncorrected after all the accommodation has been exerted is called the absolute hyperopia. It is generally present when the power of accommodation has been diminished by age.

What is latent hyperopia?

When a young person has to use a certain amount of accommodation to see even distant objects clearly, he frequently is unable to relax his accommodation entirely when looking at distant objects, even when this is not required for clear vision. The portion of the accommodation thus unrelaxed neutralizes and so conceals an equal amount of H., which is therefore called latent hyperopia.

What is manifest hyperopia?

All hyperopia that is not latent.

What is the total hyperopia?

The sum of the other varieties; that is, the latent plus the manifest.

What are the evidences of hyperopia or far-sight?

Distant vision is generally distinct until about the age of fifty, after that it is more or less indistinct. Near vision is more difficult or imperfect. The symptoms of presbyopia come on early, sometimes even in childhood. Headache is very often due to hyperopia. It may be constant, or felt only after use of the eyes for near-seeing. Chronic or recurrent congestion or inflammation of the eye or its appendages is produced by H. All the symptoms are worse in proportion to the amount of work the eyes are required to do. On testing the eyes, the near point is found too far from the eye for the age of the patient: and the distant vision improved, or at least not seriously impaired by convex lenses.

What should be done for hyperopia?

The strongest convex lens should be worn that allows clear distant vision. The most benefit will be derived by wearing the lens constantly; but in some cases the help received by wearing it for near work alone will be sufficient to give relief from all the symptoms complained of, and may be all that is necessary. If the selection of the lens is made by looking at test type about four metres from the eye, the lens chosen will be too strong for very distant vision by about 0.25 D.; and this amount should be subtracted from its strength in ordering a distance glass. If the H. has been measured when the eye was under the influence of a mydriatic, it will often be found in young persons that after the effect of the mydriatic has passed off some of the H. has become latent, and the lens is too strong to allow clear distant vision. If, however, the glass is worn, this latent H. will in a few days or a few weeks become manifest, and distant vision clear. It is therefore best, as a rule, to give the correcting lens of the full strength, warning the patient of the temporary difficulty, and promising its gradual decrease and disappearance.

What are the mydriatics?

A group of drugs, atropin, daturin, duboisin, hyoscyamin and homatropin, that when instilled into the eye dilate the pupil and render it insensitive to light, and paralyze the accommodation. They also have a powerful action on other parts of the body. All but homatropin being liable to cause dryness of the throat, flushing of the skin, and the ordinary symptoms of intoxication. For methods of using them, see formulæ at the close of the book.

What are the objections to the use of a mydriatic?

It may precipitate an attack of glaucoma in an eye already upon the verge of such an attack. The danger of an eye being in such a condition is very slight under the age of forty. Later than that, a careful search for symptoms of glaucoma should precede the use of the drug. Mydriatics will, in a few persons, cause a conjunctivitis, but commonly only after a somewhat prolonged use. The inconvenience of being deprived of the power of accommodation is reduced to a minimum by the use of homatropin, recovery from which is generally complete within two days.

Myopia.

How is myopia recognized?

The myopic eye is "near-sighted." Eyes with imperfect vision from any cause are liable to be called near-sighted, because they can see objects close to them that they could not distinguish at a distance. But the really myopic eye can see a near object better even though it be proportionately smaller. Thus, it may not be able to see the 200 feet type at 20 feet, yet read easily the 10 inch type at 10 inches. If the myopia is of high degree, the eyeball, when turned in strongly toward the nose, is seen to be visibly elongated. On testing, the near point is found to be closer to the eye than would be expected from the age; and concave lenses improve distant vision.

What are the disadvantages of myopia?

Vision is imperfect, for all objects that are not very close to the eye. Even with so little as one dioptre, nothing is clearly seen beyond arm's length. This incapacitates the myope for many kinds of business and pleasure, and renders him very liable to accidents of various kinds. When the myopia is of high degree, close work even, like reading or sewing, must be held inconveniently near the eyes, or the head must be bent down to the work in order to see clearly. Then, in order that both eyes may be turned toward the same point, they must be made to converge very much, causing strain of the internal recti muscles; and if this strain is great, the effort to see with both eyes is generally given up, and a divergent squint is the result.

What are the dangers of myopia?

It tends to increase. It is due to congestion and inflammation of the coats of the eye, particularly the choroid, with the increased fullness of the eyeball and the softening of the coats that attend congestion. But the myopia, by preventing distant vision, favors reading and similar occupations that produce congestion; and the excessive effort to turn the eyes in, and the bending the head forward to see clearly, increases it. Then, too, when the coats of the eye have already been somewhat over-distended, they are thinned and give way more readily before the distending force. The tendency to increase of M. is greatest in childhood. If once checked, it may not return during adult life. High degrees of myopia are almost invariably attended with serious damage to the choroid, which is liable to affect the tissues depending on it for their nutrition, the vitreous humor and the crystalline lens. Hence, myopic eyes are very liable to cataract, opacity of the vitreous, or detachment of the retina. Even if these are escaped, the sensitiveness of the retina is impaired, so that even at short distances or with the best correcting glasses, vision is very imperfect.

What is to be done for myopia?

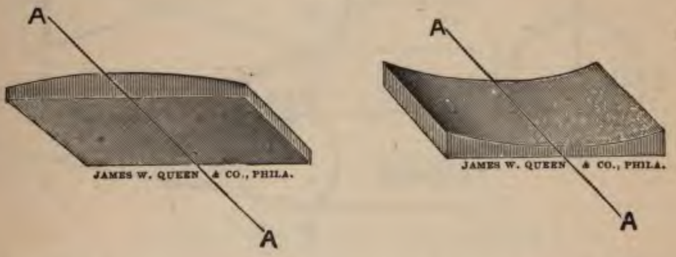
Concave lenses correcting the myopia are to be worn, and excessive use of the eyes avoided. For all but very high degrees of myopia, or M. with imperfect vision from some other cause, the glass just correcting all the myopia should be worn. For very high M. it is often more satisfactory to leave a little of it uncorrected. When the patient is young, with sufficient power of accommodation one pair of glasses serves for near or distant vision. When there is also presbyopia, weaker glasses, corresponding to the use of the proper convex lenses, are required for near work. The amount of work to be done must be graded by the effect it produces on the eye.

Astigmatism.

What is astigmatism?

That defect of the eye that causes rays not to be focused to a point as by a spherical lens, but into one or more lines, causing a point of light, as a star, to appear as a group of lines.

FIG. 13.



What is a cylindrical lens?

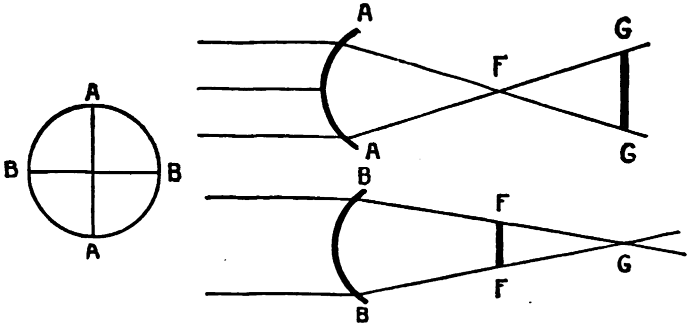
A lens, one or both surfaces of which are portions of the surface of a cylinder. While a spherical lens curves equally in all directions, the cylindrical has such a curve in one direction only; and at right angles to this it has no curvature at all. Cylindrical lenses are usually plane on one side. They may be convex or concave. They are numbered, like spherical lenses, according to their form or refracting power, in the direction or meridian of greatest curvature. The direction in which the cylindrical surface has no curvature is called the *axis* of the cylinder or cylindrical lens. See A A, in Fig. 13.

To indicate that a lens is cylindrical, the abbreviation cy. or cyl. is placed after the number indicating its strength; thus, 2 D. cyl.

How does a cylindrical lens focus light?

All along the axis of the lens the two surfaces are exactly parallel, as at the optical centre of a spherical lens, so that the rays which pass through the axis are not refracted at all. The rays that pass through other parts of the lens are turned toward the axis, or from the axis, according as the lens is convex or concave; and the focus to which they are gathered, or from which they are made to diverge, is a line parallel to the axis, instead of a single point, as in the spherical lens.

FIG. 1'.



What is the form of the dioptric surfaces of the eye that cause regular astigmatism?

The surface, usually that of the cornea, curves more in one direction than another, as does the surface of the edge of a watch, or the back of the bowl of a spoon.

What are the principal meridians of such a surface?

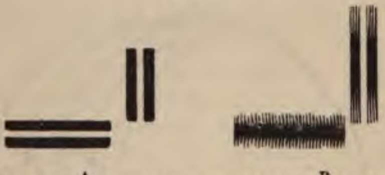
They are the direction in which the surface has the least curve, and the direction in which it curves most. These principal meridians are always at right angles to one another.

How does such a surface refract and focus light?

As with the spherical lens the ray passing through the optical centre is not refracted; while all other rays are turned toward it.

But as the curvature varies in different directions, so the extent to which the rays are turned from their original courses varies, and the rapidity with which they are brought to a focus. In Fig. 14, A A represents the meridian of greatest curvature, and B B the meridian of least curvature. In the direction of A A the rays are turned up and down so much that they are all brought to the level of the central ray at the point F. But in the meridian B B, at right angles to A A, they are not turned in from the sides so much, and consequently do not come to a focus until they get back to G. That is, the rays all converge, but unequally until they are focused in a line F F; then they begin to diverge up and down, though still converging from the sides, and this continues until they come to another focus in the line G G, and then they diverge in all directions. They are most perfectly focused at one of these two lines, which are called *focal lines*. Nowhere are all the rays brought to a single point.

FIG. 15.



A. B.

A. Parallel lines as they appear to the normal eye.
B. The same lines as seen by an astigmatic eye.

How does regular astigmatism affect the seeing of lines?

When the astigmatic eye is best adjusted, each point that it looks at makes the impression of a focal line on the retina. When a line is looked at, if it runs in the direction of these focal lines, the focal line of one point overlaps the focal line of the next, and so on, making the impression of a distinct line. But if the direction of the line looked at does not coincide with that of the focal line, the latter, instead of overlapping its neighbor, overlaps what should be the space on either side of the line, and the effect is that the line is seen not as a distinct line, but as a broad, indistinct band; and if there are two such lines close together these impressions run into one another, and they cannot be distinguished, like those in Fig. 15, B.

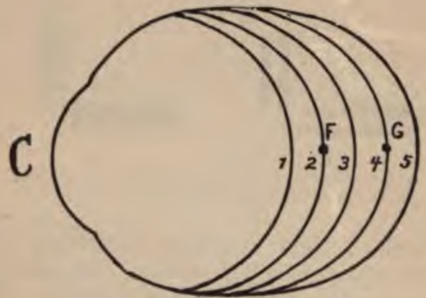
How is astigmatism corrected?

By placing a convex cylindrical lens before the eye so that its curve will supplement the weaker curve of the cornea, or by placing a concave cylindrical lens so that its curve will partially neutralize the effect of the stronger curve of the cornea. In this way the other rays are caused to turn in equally from all directions toward the central ray, and the focal lines are both brought to a single point. The correction of the astigmatism may leave the eye with some uncorrected hyperopia or myopia, requiring the proper spherical lens to be combined with the cylindrical, making a *sphero-cylindrical* lens.

What are the different varieties of astigmatism?

They are shown in Fig. 16, in which C represents the position of an astigmatic cornea, and F and G the positions of the two focal lines, 1, 2, 3, 4 and 5, different positions in which the retina may be situated. When the retina is at 1, with both the foci behind it, the error of refraction is called compound hyperopic astigmatism. When the retina is at 2, one focus on the retina and the other behind it, it is called simple hyperopic astigmatism. When the retina, as at 3, lies between the two foci, it is called mixed astigmatism. When the retina is at 4, one focus on it and the other in front of it, it is nple myopic astigmatism. When the retina is at 5, with both of

FIG. 16.



the foci in front of it, the case is one of compound myopic astigmatism.

What are the subjective signs of astigmatism

Vision both distant or near is not perfect. But the patient may regard it as perfect; and, indeed, very troublesome astigmatism may exist without bringing vision below what is usually called perfect vision.

A point of light appears elongated in certain directions.

Lines running in different directions are not seen equally well; but the patient may not appreciate this until he has had the defect pointed out.

Much use of the eyes for either near or distant seeing causes eye-strain.

Vision is improved by a cylindrical lens with its axis in the right direction; and made worse by the same lens with its axis turned at right angles to this.

How is astigmatism recognized by the ophthalmoscope?

The astigmatic cornea interferes with the vision of the surgeon looking in through it in the same way that it interferes with the vision of the patient looking out through it; it makes the lines running in certain directions indistinct. The smaller vessels between the disk and the macula are to be taken as the test object. The strongest convex, or weakest concave lens that leaves the vessels clear in a single direction, is the lens required to correct the ametropia in that axis, and the strongest convex, or weakest concave that leaves the vessels clear that run at right angles to the first axis, is the one that corrects the ametropia in that direction. The difference between the two is the degree of astigmatism.

How is astigmatism measured by the shadow-test?

On account of difference of curvature, the principal meridians have their points of reversal at different distances from the eye. Within the points of reversal the light in the pupil moves with the light on the face in all directions. At the nearer point of reversal the light in the pupil takes the shape of a band extending in the direction of the principal meridian to which this point of reversal belongs. This band is readily movable with the light on the face in the direction at right angles to it; but exactly at the point of reversal no movement can be secured in its direction. Going beyond this a reverse movement is seen in the direction of the band, while the movement at right angles to this still remains with that of the light on the face. This continues until the point of reversal for the other principal meridian is reached, where a second band appears, its direction perpendicular to that of the first band, having a reverse movement perpendicular to its own direction, and no movement in the direction of its length. Passing still further back from the eye under examination, the movement of light in the pupil is seen to be inverted in all directions. Measuring the distance from the two points of reversal to the eye, gives us the ametropia in the two principal meridians; and the difference between these is the amount of astigmatism?

What should be done for astigmatism?

The cylindrical lenses that correct the astigmatism should be worn all the time. If, on account of presbyopia or very high myopia, different glasses are required for near and distant vision, the same cylindrical should be combined with the different spherical lenses. It is important that the lens should be properly placed before the eye; therefore it is best to have the glasses examined by the surgeon whenever, from dropping out or getting broken, they require to be replaced.

What is irregular astigmatism?

The defect of refraction produced by irregularities of the cornea, such as are left by keratitis, or the irregularities of the lens, that are the first evidence of commencing cataract. While it cannot be corrected by any lens, it is often associated with a certain amount of regular astigmatism, which can be relieved by the use of the proper glass.

What is the aberration of the eye?

The rays that go through the edge of a spherical lens are focused sooner than those which pass through the lens near its centre. This difference in the power of different parts of the lens is called *spherical aberration*. There is a similar condition in most eyes, the refraction at the edge of the pupil being more myopic or less hyperopic than at the centre of the pupil; this is called positive aberration.

When this is reversed, the edge of the pupil being less myopic or more hyperopic than the centre, the eye presents negative aberration. Aberration may require the use of a lens when the pupil is contracted, different from the one selected when the pupil was dilated.

What is eye-strain?

A morbid condition resulting from over-use of the muscular, or more commonly of the nervous apparatus concerned in vision, manifested by irritation or inflammation of the eye or its appendages, especially the retina and choroid, and the conjunctiva and margins of the lids, or by pain in the eye or headache, or by so-called "reflex" disturbances of more distant organs. The headaches of eye-strain may come on only after special use of the eyes, or may be constant. The majority of all chronic or recurrent headaches are due to this cause, and headaches due in part to other causes are very often aggravated or kept up by eye-strain. The reflex phenomena have been known to include epileptic seizures, chorea, gastric and uterine disturbances, etc.

Movements of the Eyeball.

What is the visual axis?

The line joining the *fovea centralis* of the retina with the point from which proceeds the light that is focused upon the fovea. When the attention is particularly fixed upon one point, the eyes are normally turned so that that particular point can make its impression on the most sensitive part of the retina, the fovea; that is, both the eyes are turned with their visual axes to the point looked at. Such a point is spoken of as the point fixed, or the *fixation point.*

What is squint or strabismus?

A defect in the movement of the eyes, by which, while one eye directs its visual axis toward the point fixed, the visual axis of the other is directed somewhere else. The first eye is called the fixing eye, the second the deviating eye.

What is necessary to normal binocular vision?

Both eyes must have their visual axes directed toward the same point; each eye must receive a distinct impression on its retina; these impressions must be transmitted to the cortical centres of vision on the two sides of the brain; and, finally, these separate impressions must be combined so as to give rise to a single idea of the object differing in some respects from either of the impressions from which it is built up. This combination of the two impressions into one is called binocular fusion.

What is the mechanism of binocular diplopia?

If one eye is fixed on a certain point, and the other turned elsewhere, the image of that point falls on the fovea of the fixing eye, but upon some other part of the retina of the deviating eye. To the fixing eye the object appears to be in the direction that the eyes are turned, while to the other it appears to be in some other direction. From these two impressions, referred in two different directions, the mind gets the idea of two separate objects some distance apart. The impression made on the fixing eye is called the true image, and the impression made on the deviating eye is called the false image.

How can you determine which image belongs to the right eye and which to the left?

By placing a piece of red glass before one eye, and finding which image is colored by it; or by covering one eye and noting which image disappears; or by placing a prism with its base up or down before one eye and noting which image is correspondingly displaced downward or upward.

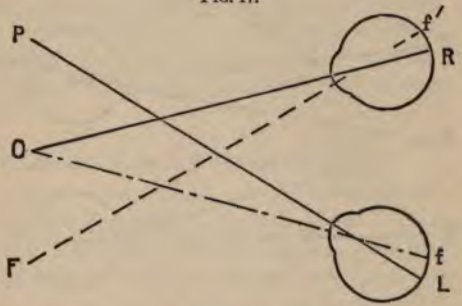
What is the relative position of the false image?

The conditions of convergent strabismus are represented in Fig. 17. The eye R fixes on the point O. The eye L deviates toward some other point P. In R the image of O is formed at the macula fovea, in L it falls at some other point, f. The false image is therefore referred in the direction f′F to a point; F, f and f′ being corresponding points in the two retinas, that is, points removed equally and in the same direction from the fovea. In general the false image appears to be in the direction opposite to that in which the deviating eye is turned. If the eye deviates up, the false image appears below the true, if downward, above; if the deviation is to the right the image is to the left, if to the left the image is to the right. If the eye is rotated one way about its visual axis the image appears to be rotated the other way.

How do you certainly recognize the presence of squint?

Simple inspection will often reveal the defect, but this is not always to be relied on, because, if the centre of the cornea be situated a good deal to one side of the visual axis, as we judge the direction of the axis by the position of the cornea, the eyes may be thought to squint when really properly directed or may really squint when apparently straight. The patient's gaze should therefore be directed toward a certain point and then the fixing eye covered, and immediately the position of the eyes will change so that the other eye can fix on the object, while the originally fixing eye deviates. This test should be repeated until the result is certain, the movement of the eyes when one is covered being satisfactory evidence of the existence of the squint; and the direction of the movement showing in which direction the eye had been deviating.

FIG. 17.



What are the two principal kinds of squint?

Concomitant and *paralytic.* They differ radically in origin, symptoms, course and prognosis and treatment.

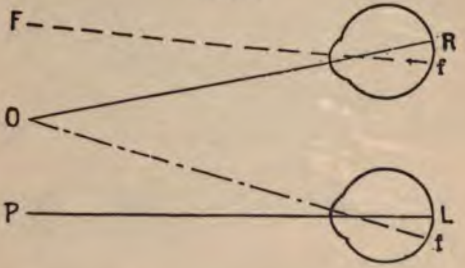
What is concomitant squint?

A wrong relation of the visual axes, so that they do not intersect in the point looked at; without marked limitation of the movements of either eye in any particular direction. The squint remains substantially the same whatever direction the eyes may be turned. When the fixing eye is covered, the other promptly fixes and the covered eye deviates, without any change in the position of the head.

What is convergent squint?

The condition in which the visual axes converge too strongly, so that they cross each other nearer to the eyes than the point fixed, as in Fig. 17. It is the most common form of squint. It gives rise to diplopia in which the image belonging to the right eye is seen to the right, and the image belonging to the left eye to the left; this is called *homonymous diplopia*. It is usually associated with hyperopia, and in some cases is caused by the excessive accommodation rendered necessary in hyperopia of the higher degrees, accommodation and convergence being actions habitually closely associated.

FIG. 18.



What is divergent squint?

The condition in which the visual axes do not converge enough, either intersecting beyond the point fixed (*relative squint*), or actually diverging (*absolute squint*), so that they do not intersect at all. This is illustrated in Fig. 18. It causes a diplopia in which the image from the right eye is seen to the left, and the image from the left eye to the right, *crossed diplopia*. It is frequently due to myopia. Highly myopic eyes do not need to use their accommodation, so there is not that stimulus to convergence there is in hyperopic eyes. Then a highly myopic eye, being elongated from before backward, is oval and fits in an oval socket, in which it cannot turn except by changing the shape or direction of that socket by actually pressing aside some of the orbital tissues composing it. So that convergence is actually more difficult for an elongated myopic eye than it is for a spherical eye, which turns freely in its spherical socket without changing its shape. Hence, eyes that are highly myopic, unless the M. is corrected, always come to have a divergent squint, either relative or absolute.

What is vertical squint?

That condition in which the visual axes do not lie in the same plane, but one is turned relatively upward or downward, as compared with the other. It gives rise to a diplopia in which one image, that from the eye that is turned down, is higher than the other, called *vertical diplopia.* Usually it is associated with divergent or convergent squint.

What is monolateral or monocular squint?

The condition in which one eye is habitually fixed upon the object, while the other eye habitually deviates. The squint is really not confined to the latter; one is as much at fault as the other, but there is a decided difference in acuteness of vision between the two, and on this account the one that sees the better is habitually used, and the other allowed to deviate. If the eye having the better vision be covered so as to prevent its use, it is promptly caused to deviate, while the worse eye is brought into use and fixes the object. As soon, however, as the better eye is uncovered, it again fixes and the worse one resumes the squint. The squint is practically the same whichever eye exhibits it.

What is alternating squint?

That form in which part of the time it is one eye that squints, and part of the time it is the other that deviates. If at any time the fixing eye be covered, the squint is promptly transferred to it, and it continues to deviate after it is uncovered, until in some way the seeing of the other eye is interrupted. This form occurs when the acuteness of vision is about the same in one eye as the other. A modified form of it is seen when one eye sees better at a distance, and the other has the better near vision.

What is intermittent or periodic squint?

One that is only present a certain part of the time, while at other times the direction and movements of the eyes are quite normal. Its periodicity is not usually regular, but is apt to bear some relation to the condition of the general nervous system. Accompanying strong effort at accommodation it is called accommodative squint, with convulsions convulsive squint, as a manifestation of hysteria, hysterical squint. The opposite of periodic is constant squint, where the visual axes are never brought into normal relations; but in many cases of constant squint, the amount of deviation at different times varies greatly. Care must be taken not to confound paralytic with intermittent squint.

How is amblyopia connected with squint?

Squinting eyes rarely have full normal vision. In very many cases this is due to some evident defect in the eye, as an opacity of the cornea or other refractive medium, or a considerable error of refraction; but in others the cause is not so evident, being probably lesion or defective development of the optic nerve or the visual centres. In some of these latter cases, it has been supposed that the squint caused the amblyopia, by inducing a suppression of the false image coming from the deviating eye to prevent the annoyance of diplopia, and such impairment of vision was called *amblyopia ex anopsia.* Such a supposition, however, does not seem to be sufficiently supported by observed facts; and it is much more probable that it is the amblyopia that causes the squint. The perfectly accurate coördination of the movements required for binocular vision, is only attained by practice in the use of the eyes during the early years of life. And when for any reason the guidance of these movements by the aid of the impressions received on the retina is interfered with, such perfect coördination may never be secured, and the imperfectly seeing eye be left in a wrong position or squinting.

How would you treat concomitant squint?

If just commencing in a child too young to wear glasses, it may sometimes be checked permanently, if the accommodation be paralyzed, by a solution of atropia: see drugs and formulæ. If this remedy fails to stop the squint, or very greatly diminish it within two weeks, it should be discontinued. But if it stops the squint, it should be continued several weeks, and returned to if the squint recurs on discontinuing it. If the squint is well established, it may be well to drop atropine into the good or fixing eye, to compel the patient to use the other, and so avoid the establishment of a false fixation or reference point. Occasionally squint seems to depend on some temporary condition of the nervous system, and may pass away with a restoration of the general health. Such cases often do not return to a normal condition, but go over into the class of dynamic squint, to be mentioned presently.

What can be done for squint by glasses?

When hyperopia coexists with convergent strabismus, the full correction of the H. will generally lessen the amount of deviation, and if the squint is intermittent, or if the H. is of high degree and the squint quite variable in amount, will commonly cure it altogether. But if the squint is quite constant and the H. of low degree, a complete cure by such measures is not to be looked for. In myopia with divergent squint the use of the glasses correcting the M., or nearly all of it, is generally advisable, and will cure a considerable proportion of cases. The diplopia of vertical squint can sometimes be relieved by the wearing of the proper prismatic glasses. Glasses for squint should be worn constantly.

What are the indications for tenotomy?

A constant concomitant squint that persists in spite of the use of atropia and glasses, that is of long standing, and in a person over six years of age, and is not of such high degree as to call for the advancement of the opposite tendon. If the squint is of very low degree, or quite variable in amount, the operation could be deferred until after puberty. The tenotomy is to be done on the muscle toward which the eye deviates, and if necessary to get sufficient effect, on the same muscle of the other eye at a later period. If one operation only is required, the worse eye is chosen.

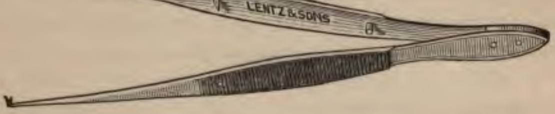
What instruments are required for a tenotomy?

A pair of toothed forceps, like Fig. 19, with fine points and rather projecting teeth.

A pair of scissors slightly curved on the flat, with fine, but somewhat blunted points, and preferably with spring handles, like those of the author shown in Fig. 20.

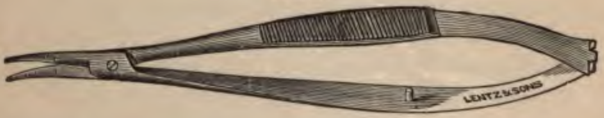
A strabismus hook, with the end bent about perpendicular to the shank, this end being less than one millimetre thick, and about six millimetres long, shown in Fig. 21.

FIG. 19.



And if the operation is done without an assistant, a stop speculum will be required.

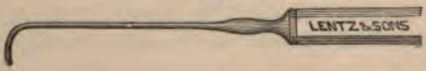
FIG. 20.



How is the operation of tenotomy done?

Cocaine solution having been dropped on the conjunctiva over the insertion of the tendon to be divided, and the patient's head being supported by the assistant who keeps the eye opened, the conjunctiva is grasped with the forceps in such a way as to raise a fold parallel to the corneal margin over the insertion of the tendon, and this fold is divided a little below the middle of the insertion with the scissors, making a cut several millimetres long in the conjunctiva in the direction radiating from the centre of the cornea. Through this cut the subconjunctival tissue is divided freely in all directions,

FIG. 21.



separating the superficial from the deeper tissues. The forceps are then introduced and made to seize the tendon near the centre of its insertion, and raise it from the sclerotic. In doing this the fold of tendon is to correspond to the direction of the tendon, and it is to be cut across at its junction with the sclera. Through the opening thus made the hook is to be introduced, and first the upper then the lower part of the tendon raised on it and divided with the scissors as close to the insertion as possible. The eye should subsequently be kept closed, and the other eye not used for a few hours.

What is the operation of advancement?

After severing the tendon toward which the eye is turned, in cases in which the deviation has been very great, it is necessary to do this operation. An incision is made parallel to the margin of the cornea, down to the insertion of the tendon, opposite the one that has been cut. The tendon is isolated and grasped with a special pair of forceps, divided at its insertion, and perhaps a piece of it cut off. Sutures are then introduced through the margins of the tendon, and carried well below and above the cornea, and one through the centre, and the tissue at the lateral margin of the cornea. By the tightening of these sutures the tendon is brought forward toward the cornea, or rather the eye is turned in the direction of the advanced tendon. The operation is more severe than that of tenotomy, and requires the rest of both eyes under a bandage for two or three days.

What is heterophoria, or latent or dynamic squint?

A tendency to turn the visual axes in different directions, which is overcome in order to avoid the diplopia it would cause, by an extra effort on the part of one or more of the muscles that move the eyeball. This extra effort may result in eye-strain. This condition is often spoken of as "*insufficiency*" of a certain muscle or muscles, but this term is better reserved for those cases of actual paresis of one or more muscles, and which bear the same relation to paralytic squint that heterophoria does to concomitant squint.

How is heterophoria detected and measured?

On covering the eye, and so preventing binocular diplopia, the extra effort to keep the eyes straight is relaxed, and the covered eye is allowed to deviate in the direction in which it tends, but upon uncovering, it quickly resumes its original forced position. This recovery is usually more rapid, and therefore more noticeable than the deviation. Its extent indicates the degree or amount of heterophoria present. Again, by placing a prism of sufficient strength before one eye, diplopia is rendered inevitable, and any extra effort is relaxed. If, now, there be no tendency to deviation, the false image will appear just where the prism used would throw it. But if there be heterophoria the eye behind the prism will deviate, and the image seen by it will have a corresponding false position. The strength of the prism required to bring the false image to the position it would take in *orthophoria* (tending of the visual axes toward the same point) is the measure of the degree of heterophoria.

What are the varieties of heterophoria?

Exophoria, a tendency toward divergence, latent divergent squint; *esophoria*, a tendency toward excess of convergence, latent convergent squint; and *hyperphoria*, a tendency of one visual axis above the other, latent vertical squint.

What is the treatment for heterophoria?

Where it is temporary or its degree is quite variable, measures calculated to improve the general condition of the nervous system are mainly to be relied on, with regulation of the work required of the eyes, and the performance of special exercises for the eye muscles. When the faulty tendency is found to remain constant for a considerable time, prisms should be worn of such strength, and turned in such direction that the eyes will be allowed to deviate in the direction they tend, and the strain of keeping them straight avoided. If such a tendency is found to persist for a considerable time an attempt may be made to correct it, as in manifest squint, by tenotomy of the muscle toward which the eye tends to turn, or advancement of its antagonist without tenotomy.

What is paralytic squint?

The deviation which occurs when the attempt is made to turn the eyes in certain direction by means of a muscle or muscles partly or wholly paralyzed. When this is done the eye with sound muscles turns normally, but the eye with the paralyzed muscle lags behind, beginning to deviate as the eyes are turned, so that this muscle is required to perform its function, and deviating more as a greater effort is required. The degree of squint and of separation of the double images it causes varies with the direction the eyes are turned, there being none at all in certain directions.

How do you ascertain the presence and variety of paralytic squint?

By having the patient turn his eyes successively in various directions, and noting the eye that deviates, and what particular movements it fails to properly execute. Also, by having the patient notice the kind and extent of his diplopia, bearing in mind that the false image appears in the direction opposite that in which the eye deviates.

What are the causes of paralytic squint?

Direct injury to the muscle concerned, lesion of the centres governing its action, or lesion to the trunk of the nerve supplying the muscle, palsies of the last kind being by far the most frequent. The most common cause of such lesions is tertiary syphilis; and after it local neuritis due to the rheumatic diathesis, "cold," or local injury, as from blows on the head.

How are cases of paralytic squint classified?

According to the nerve involved.

What are the manifestations of oculo-motor paralysis?

Ptosis, or falling of and inability to raise the upper lid, due to paralysis of the elevator of the lid; inability to move the eye, except outward and downward, from its central position, due to paralysis of the internal, superior and inferior recti. This causes a divergent or vertical squint on endeavoring to converge the eyes or to look toward the side of the sound eye, or upward or downward; with crossed, or more or less vertical diplopia. The inferior oblique muscle also suffers. If the case is of long standing, the eye is permanently turned down and out. Sometimes only one or a part of the muscles are involved. Loss of the power of accommodation, and partial dilatation of the pupil may be present, from involvement of the part of the nerve distributed within the eyeball.

What are the effects of abducens or sixth nerve paralysis?

Convergent squint and homonymous diplopia on looking toward the side of the affected muscle, due to loss of power in the external rectus muscle, to which this nerve is distributed. This is the commonest form of paralytic squint.

What are the symptoms of paralysis of the patheticus or fourth cranial nerve?

Loss of power in the superior oblique muscle, causing imperfect movement of the eye down and out; and on attempting to look in that direction homonymous diplopia, but with the false image lower than the true, and with its top inclined toward the true.

What is ophthalmoplegia externa?

The simultaneous paralysis of all the muscles that act on the exterior of the eyeball.

How would you treat paralytic squint?

Remove any obvious removable cause, secure as favorable conditions of nutrition as possible, and in recent cases give potassium iodide in increasing doses until decided improvement occurs, or the limit of physiological tolerance is reached, and at a later stage give strychnia in the same way. Locally, stretching of the muscle may be resorted to, by seizing the insertion of the muscle (after the instillation of cocaine) and dragging it back and forth for a few minutes. Prisms, tenotomy and advancement are usually of no service in these cases.

What is nystagmus?

A disorder of the motility of the eyes, in which the eyeball oscillates rapidly from side to side or vertically, or with a rotary movement; nearly always associated with imperfect vision, generally congenital, not directly amenable to treatment, but often improved by attention to general or local hygiene, or the removal of sources of strain, and improvement of vision, as by glasses.

Methods of Diagnosis, and Functional Conditions.

What is the field of vision?

The space before the eye in any part of which an object of sufficient size can be seen. When not otherwise indicated, it is to be taken as the space in which objects can be seen by one eye without any change in the direction of its visual axis. The *binocular field* is the whole space in which they can be seen by either eye, or both, by turning the eyes, but without changing the position of the head. The *field of fixation* is that part of the field of vision in which objects can be directly looked at; that part toward which the visual axis can be turned. The *field of binocular fixation*, or true binocular vision, is the part in which both eyes may be made to fix the object at the same time.

How can you ascertain the field of vision?

Cover effectually the eye not to be tested, then face the patient and close your eye that is opposite his covered one; in testing the left eye keep open your right eye, and *vice versa*. If they are both normal your field of vision will now correspond with the patient's, for any object that is equidistant from both. Hold the hand in different directions, and find if the patient can tell whether the fingers are kept still or moved, as far in every direction as you can perceive them, making due allowance if his brow or nose be more or less prominent than your own. During the test the patient's eye must be steadily fixed on yours, while your own is as constantly directed toward his.

What is a perimeter?

An instrument with a graduated arc that can be revolved so as to describe the surface of a hemisphere, along which are the test object can be moved. The visual axis of the eye to be tested is made to coincide with the axis about which the arc turns, and the portion of the hemisphere in which objects can be seen noted. A more exact outline of the field of vision is thus obtained.

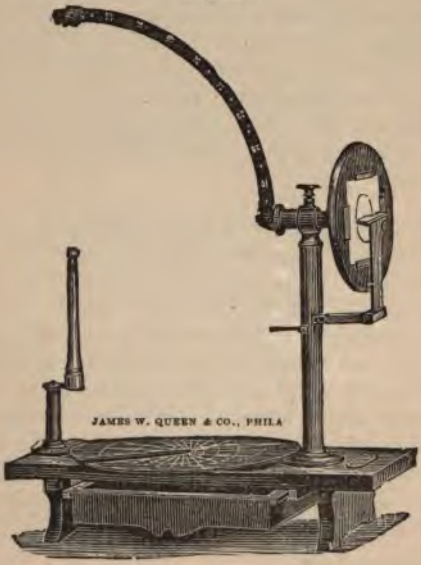
How may the field of vision be affected by disease?

It may be contracted, either concentrically, that is, evenly in all directions, or irregularly; or it may present *scotomata*, patches in which there is partial or complete blindness, surrounded by parts where vision is partly or entirely retained.

What is amblyopia?

Impairment of vision in a part or the whole of the field, without any perceptible lesion or anomaly of the eye to account for it.

FIG. 22.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What is amaurosis?

Complete loss of sight, without perceptible lesion of the eye to account for it.

What is hemianopsia?

A form of irregular contraction in which one-half of the visual field is obliterated. When objects cannot be seen to the temporal side of the field of vision, it is called *temporal hemianopsia*, and to the nasal side, *nasal hemianopsia*. When the temporal or the nasal half is lost from the fields of both eyes, it is called bi-temporal or bi-nasal hemianopsia. When the right or the left half of the field is affected in both eyes, it is called *homonymous hemianopsia.*

What is the significance of homonymous hemianopsia?

It indicates a lesion of the visual centres or of the optic tract, on the side opposite the blind field, somewhere back of the optic chiasm, and is therefore of great importance in locating cerebral disease.

What is the significance of bi-temporal hemianopsia?

A lesion involving the chiasm itself.

What can cause blindness of one eye without affecting the other?

Only a lesion in front of the optic commissure or chiasm.

How can you detect hysterical amaurosis?

If both eyes are involved, only by watching the actions of the patient, especially when some sight calculated to awaken strong emotion, as fear, is suddenly presented to the view; or by etherizing the patient and watching his behavior as he comes from under the influence of the drug. But if only one eye is involved, a prism strong enough to produce binocular diplopia may be placed before the good eye, and the question asked, Does it make things look double? If it does, he is seeing with both eyes. Or glasses may be placed before both eyes at the same time, the one before the good eye of such strength that it prevents clear vision, while the one before the other allows it. Then if he is able to read with both eyes open, he does it with the eye supposed to be blind.

What is color blindness?

Inability to receive from certain colors the impression that they usually make on the normal eye. The colors that most notably fail to make the proper impression are red and its complementary color green. These do not usually appear as black, but are not distinguishable from each other, or from certain grays and browns. The defect may be partial, so that only certain delicate shades are confused or total, the brightest red being indistinguishable from the brightest green. Even partial color blindness is very dangerous in one who has to distinguish red and green signals at different distances and under varying atmospheric conditions.

How is color blindness detected?

Best by the Holmgren test, in which a test skein of wool, of light pure green color, is given the person to be tested, and he is told to select from a mass of similar skeins of various colors those of the same color as the test, including lighter and darker shades. If color blind, he will include some of the pale shades of other colors, known as confusion colors. As a second test, he is given a rose-colored skein to be matched in the same way.

FIG. 23

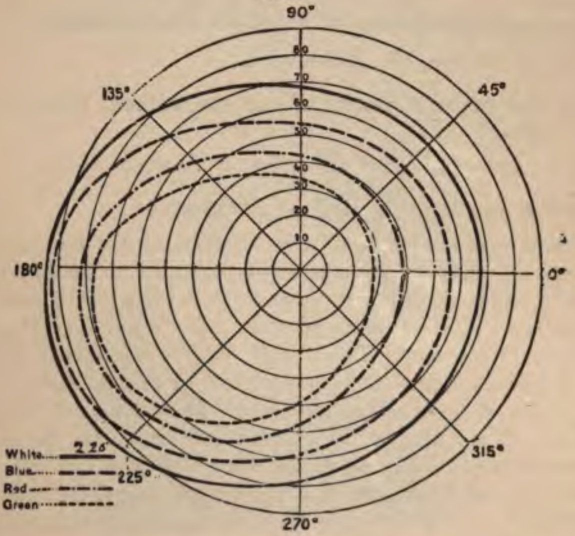


Chart of the normal fields of vision for white and colors. (*After Landolt.*)

How large is the normal field of vision for various colors?

It varies for the different colors. The relative sizes for some of them are shown in Fig. 23. They are all smaller than the field for white. The field for yellow is usually smaller than the field for blue. The size of the field for any color varies considerably in different persons, and for the same person with different degrees of illumination.

How is color perception affected by disease?

There may be concentric narrowing of the fields, which may be extreme or go on to the complete obliteration of the field for one or more colors, as in optic atrophy; or there may be a scotoma, usually including the point of fixation and neighboring regions, while the outer margins of the field of vision remain normal.

How can you test the field of vision for the different colors?

In the same way as the field for white or for form, except that a colored object, as one of the Holmgren wools, is to be used. It is well to hold several of these in the hand, and exposing one at such a distance from the centre of the field that it cannot be recognized; move it gradually toward the centre of the field, until the patient is able to name the color with certainty, while still keeping his eye directed toward the original point of fixation.

What is chromatopsia?

The condition in which all objects appear more or less tinged with a certain color, as blue or red. It occurs most frequently in old people, as after cataract extraction. Usually objects recover their normal appearance after some days or weeks.

How would you make a simple inspection of the eye?

Place the patient in the best accessible light, not exactly facing it, but still well exposed to it, and before touching the eye or lids, notice the color and form of the lids, the width to which they are separated, the appearances and position of the lashes, any evidences of discharge, and the redness of the portion of the eyeball exposed to view. The patient may be directed to look up to secure a wider opening of the lids, or to look in various directions to expose different parts of the globe. The lids are then to be gently separated by pressing the ball of the thumb on one and the forefinger on the other. If done gently, so as not to provoke resistance, very little force is required if both the lids and the hand are perfectly dry, so that they stick together. The pressure should be made over the brow and lower margin of the orbit, not on the part of the lid resting on the eyeball. With the lids thus separated, the position and appearances of the lacrymal puncta are to be noted, and the eyeball more fully inspected.

How do you evert the eyelids?

The lower, by simply pulling down the skin of the lid and getting the patient to look up. The upper, by having the patient look down so as to relax the elevator of the lid, then seizing the free margin of the lid between the thumb and finger of one hand, drawing the lid downward and a little from the eyeball, until it is slightly on the stretch. Then place the end of a probe, lead pencil or similar object upon the lid at the point where it is designed to fold it over. This must be at the upper margin of the cartilage, say a half-inch from the margin of the lid. And with the probe or pencil make enough downward pressure to keep the upper part of the lid on the stretch, when the drawing of the thumb and finger is relaxed. With the upper margin of the tarsal cartilage thus fixed, the free border of the lid is to be raised, and the lid thus folded upon itself. The probe may then be withdrawn, and simply keeping the free margin of the lid pressed against the part on which it is folded, will keep the lid from turning in again. Care must be taken to have the lid pulled well down, and to apply the probe point far enough up from the lid margin, and not to let the whole lid slip up when the attempt is made to raise the free margin. When an infant cries and strongly closes the lids, to evert them it is only necessary to have lids and fingers thoroughly dry, so that they will stick, and pressing thumb and finger on the respective lids at their free margin, separate them. When the margins of the lids are thus separated, the violent contraction of the orbicularis presses in the orbital margin of the cartilage in place of the probe, that would otherwise be needed upon the lid.

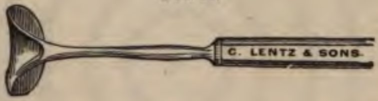
What should be noted as to the everted lids?

Their redness, and the degree of swelling, and opacity of the conjunctival and subconjunctival tissue. Normally these are transparent, and we readily see through them the vessels, and the yellowish stripes perpendicular to the lid margin that mark the position of Meibomian glands. Swelling may be a general thickening, or may cause unevenness of the surface, as granulations of various sorts. Opacity may be due to changes in the epithelium or exudate in deeper tissues. Cicatrices, tumors, and changes in color that mark the seat of a chalazion or tarsal cyst are also to be noted.

How is a view obtained of the upper cul-de-sac of the conjunctiva?

So-called eversion is only a folding of the upper lid on itself and does not reveal the whole of its under surface. To do this, have the eye turned down as strongly as possible; then draw the lid away from the globe as much as possible and throw the light into the space so exposed (here the ophthalmoscope mirror may be useful), and look in the direction of the narrow space thus obtained. To raise the lid from the globe, and also to keep the eye open during operations, and sometimes to get a view of the cornea in children, the lid elevator or lid retractor, such as is shown in Fig. 24, is very useful.

FIG. 24.



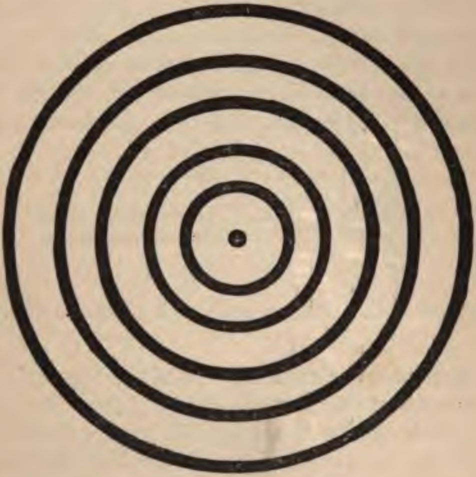
What is the catoptric examination of the cornea?

The inspection of reflections formed by the surface of the cornea. It may be made by placing the patient facing a window, and while he rolls the eye in various directions watching the image of the window formed by reflection from the corneal surface. Any irregularity due, for instance, to a foreign body or a corneal ulcer, or cicatrix, will cause a break or distortion of the margin of the image of the window as it passes over it. In place of the window, a white card, strongly illuminated, may be held before the eye and its reflection studied. Or better still, for the detection of irregularities due to previous inflammation, we may in the same way use a card marked with alternate rings of black and white, called a Placido's disk, and shown in Fig. 25.

What is the ophthalmometer?

An instrument for measuring the size of images formed by reflection from the cornea; and so determining the curvature of the cornea, on which the size of the image depends. With it the corneal curvature can be measured in different meridians, and thus the presence and amount of corneal astigmatism determined. Since, however, the refraction of the eye depends also on the curvature of the lens and the length of the eyeball, it is an instrument of value mainly for purposes of original investigation.

FIG. 25.



What is the catoptric examination of the crystalline lens?

The study of the reflection from its posterior surface. The pupil should be somewhat largely dilated. The examination is made in a dark room. The patient is to face the surgeon and a candle or lamp flame, and to look half way between the flame and the surgeon's face. The surgeon sees a bright image of the flame reflected from the patient's cornea, and within the pupil a second very much fainter image, which is formed by the reflection from the posterior surface of the lens. When the lamp flame is moved about the corneal image is seen to move in the same direction, but the lens image moves in just the opposite direction. When the lens image can be seen it proves that the lens is present in its proper position and transparent.

How do you examine the eye by oblique illumination?

Place the patient so that the source of light, preferably a bright lamp flame in a darkened room, shall be on the side of the eye to be examined, but a very little in front. The observer places himself directly in front of the patient, and concentrates the light on the anterior part of the eye with a strong convex lens. From time to time the eye may be turned in different directions, so that the light will strike it at various angles.

What is to be especially looked for by this method of examination?

Foreign bodies or opacities of the cornea, such as are due to cicatrices, exudate, pus, blood-vessels, etc., and specks of opacity on the capsule of the lens, or in the substance of the lens itself, or even in the anterior portion of the vitreous chamber, or in the anterior aqueous chamber. The appearance of the iris is also to be thus studied.

How do you test the tension of the eyeball?

Let the eye be turned down and the lid allowed to close passively, that is without any spasm of the orbicularis. Place the tips of the two forefingers on the lid just under the brow, and press alternately with first one and then the other, and judge how much pressure you have to exert in order to dent the eyeball. The lid is allowed to fall in order that the fingers may be applied above the cartilage, through the thinner more flexible portion of the lid. Another way is to have the patient look up, and then make the test on the lower part of the exposed sclerotic, or through the lower lid. Where one eye is normal apply the test alternately to the sound and the suspected eye. Or, if both eyes are suspected, use your own eyes as a standard for comparison, remembering that the sensation produced varies with the thickness of the lids, and the rigidity of the sclerotic in different persons. Certainty and confidence in this manœuvre are only to be attained by many trials.

How is the state of tension of the eyeball indicated?

By the letter T, to which is prefixed the sign +, when the tension is increased above the normal; and the sign — when the tension is below the normal. It is also customary to indicate the degree of departure from the normal by the numbers 1, 2 or 3, but these are not to be taken as having any definite value. Thus: +T1 is simply a short way of indicating that the tension is certainly increased, but not very much; +T2 means tension increased a good deal, but not so high as it is sometimes found to be; and +T3, that the eyeball is of great, or "stony," hardness.

Diseases of the Lids.

What is marginal blepharitis?

A chronic inflammation of the skin of the lid margin, usually associated with conjunctivitis, and often leading to changes in all the tissues of the lid. There are two forms, a squamous, in which the lid margin is reddened and covered with fine scales, both eyes being equally affected; and an ulcerous or pustular form, in which the lashes are matted together with scabs, under which are ulcerations, and the inflammation involving the roots of the lashes these become deformed, drop out, and if the disease continues are finally destroyed altogether. The lid often becomes considerably thickened and its margin rounded, and the few remaining lashes displaced.

What is the treatment for marginal blepharitis?

Remove eye-strain or any general vice of nutrition that may act as a factor in causation. Carefully and persistently treat the conjunctivitis, especially by applications to the inner surface of the lids. When scabs or crusts are present have them removed after thorough soaking in warm water at least once daily, and when such removal leaves an open ulcer touch its raw surface with a solution of silver nitrate. The ointment of the yellow oxide of mercury should be applied to the margin and inner surface of the lid, and gently, but thoroughly rubbed in daily, after the removal of the crusts.

What is hordeolum or stye?

A circumscribed purulent inflammation occurring in the eyelids near their margin, and usually centering in a hair follicle. It may be attended with local swelling of the conjunctiva, and when near the outer canthus may cause great swelling on both lids. It usually runs its course in a few days. But a succession of them is apt to occur, and sometimes several at once.

How is stye to be treated?

The closed lids may be bathed three or four times a day with very hot water, and borax and boric acid solution instilled if there is smarting of the conjunctiva. When suppuration has occurred the stye may be opened, though this is often unnecessary. If, after once opening, the stye inclines to scab over and become chronic, the scab should be removed, the cavity emptied, and its interior touched with the point of a crystal of copper sulphate. To prevent a succession, eye-strain should be carefully sought for and corrected; and internally a saline laxative, and the tincture of the chloride of iron or some similar preparation, with small doses of quinine may be required.

What is chalazion or meibomian cyst?

A small tumor of the lids due to retention in some part of a meibomian gland of its secretion. It causes an elevation in the skin of the lid, beneath which may be felt a lump of firm consistence, closely connected with the cartilage. On the inner surface of the lid is no projection, but a spot of grayish discoloration, marking the point at which the cartilage has been absorbed, allowing the cyst to extend outward. These tumors tend to persist indefinitely if not removed, and they are often multiple.

How would you treat a chalazion?

Evert the lid, and after the application of cocaine, make a free incision through the discolored spot; press out the contents of the cyst, and scrape its walls with a corneal spud or similar instrument. Re-accumulation of the cyst contents will be more certainly prevented if in addition the interior of the sac is touched with the crystal of copper sulphate. Often the cavity is left full of blood, so that the patient must be warned that the tumor will only gradually disappear.

What other peculiar growths are there on the lids?

Sometimes a tumor very similar to a chalazion will develop in connection with the skin of the lid, but it is freely movable over the cartilage, and causes no discoloration of the inner surface of the lid. It should be opened through the skin by an incision parallel to the lid margin. *Milium* is the name given those white tumors the size of a pin-head, that occur in the skin of the face from retention of the secretion of the sebaceous glands. *Molluscum* is applied to an inflamed umbilicated tumor the size of a split pea, apparently contagious, and requiring excision. Syphilis, rodent ulcer, lupus, epithelioma, sarcoma, and nævus of the lid occur.

What is xanthelasma?

A fatty degeneration and infiltration of small areas of skin, in consequence of which the surface of the part affected is slightly elevated, smooth, and of a yellowish appearance, often compared to wash-leather. It is apt to appear on the lids in elderly persons, and to be symmetrical in its distribution. It is not indefinitely progressive, and requires no treatment.

What is blepharospasm?

A tonic contraction or cramp of the orbicularis muscle, preventing for the time the voluntary separation of the lids, usually coming on suddenly, and lasting from a few seconds to days or weeks. Sometimes it seems to be the reflex of some peripheral irritation, usually of a branch of the trifacial nerve, and in other cases its cause is quite obscure. In some cases it is a manifestation of hysteria. Its treatment should first be directed to the causes; should other measures fail, stretching, or division of the branches of the facial nerve going to this muscle, may be resorted to. Blepharospasm must not be confounded with a frequent twitching of the lids, which is quite common, and which is to many people quite annoying. This twitching may be dependent on local irritation or on eye-strain, but is often more intimately connected with the general condition of the nervous system.

What is ptosis?

Inability to raise the upper lid. It is due to deficiency of the muscle itself, paralysis of the branch of the oculo-motor nerve supplying it, or the presence of an accumulation of fat or some new growth in the lid itself. In the latter case it may be treated by the removal of the mass that prevents the movement of the lid; and when due to paralysis of either muscular or nervous origin, it is in some cases worth while to bring the lid under the control of the frontalis muscle by excising a piece of the skin of the lid, or by connecting the centre of the lid with the brow by a subcutaneous cicatrix, secured by the use of a suture.

What is lagophthalmus?

Inability to close the eye completely. It may be due to paralysis of the part of the facial nerve supplying the orbicularis, this part of the nerve in palsies of central origin being sometimes paralyzed when other parts escape, and sometimes escaping when other parts are paralyzed. Or it may be due to cicatrices involving the lids, or to bulging or forward displacement of the eyeball. In such cases it may be best to narrow the palpebral fissure by removing the skin from the edge of both lids near the outer canthus, and stitching them together; this operation is called tarsorraphy.

What is blepharophimosis?

The condition of undue narrowing of the palpebral fissure. It is a deformity that rarely requires treatment unless the eye becomes the seat of a chronic conjunctivitis, in which case it aggravates the disease and constitutes a serious obstacle to the proper eversion and treatment of the lids. It is to be remedied by the operation of *canthoplasty*, in which an incision is made extending outward from the outer canthus (see Fig. 26), and the skin and conjunctiva are brought together by three sutures, one for the upper lid, A, one for the lower lid, B, and one at the junction of the lids, C; and by the separate healing of the two lids the palpebral fissure is thus permanently widened.

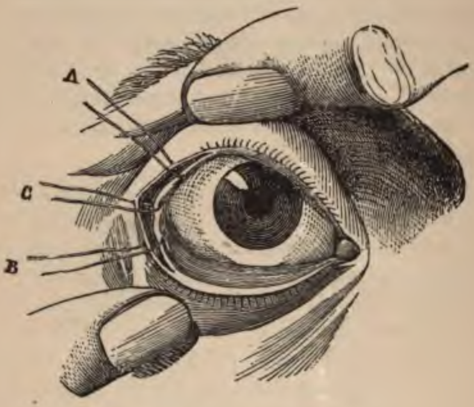
What is ankyloblepharon?

An adhesion of the margins of the upper and lower lid, causing partial closure of the palpebral fissure; the advisability of attempting a separation of the lids depends on the probability of freedom from adhesions of the lid to the globe, as indicated by the apparent freedom of movement of the eyeball beneath the lids.

What is symblepharon?

The union of the conjunctiva lining the lids with that covering the eyeball, usually by bands or masses of cicatricial tissue left after burns by hot metal, quicklime or acids. When it causes marked deformity, or impairs the usefulness of the eye by hindering its movements or preventing a sufficient separation of the lids, it calls for operation. The great obstacle to its relief is its tendency to recur with cicatrization after any operative interference. Many attempts have been made to overcome this by means of some glass or metal shield introduced between the lids and globe and worn more or less continuously, but such attempts all fail.

FIG. 26.



How can symblepharon be cured?

Narrow bands or adhesions that are isolated, do not extend to the junction of the lids and globe, may simply be divided. In cases of more extensive adhesion the lid is to be dissected from the globe, and the raw surface thus made on the inside of the lid carefully covered by a piece of conjunctiva transplanted from the rabbit.

What is entropion or entropium?

A turning-in of the lid or lid margin so that it presents the lashes toward the conjunctival surface of the other lid, or toward the eyeball itself. It may be due to spasmodic contraction of the orbicularis muscle, to relaxation of the skin of the lid, as is seen in old people, senile entropion, or to cicatricial contraction of the conjunctiva, or the cartilage and other tissues of the lid.

How is entropion to be treated?

The spasmodic contraction generally arises with the use of the bandage, or from some acute swelling of the lids, and is cured by removal of the cause. When it is due solely to relaxation of the skin, removal of a sufficiently wide strip of skin parallel with the lid margin may be all that is required. But when it is due to cicatricial contraction, a well-planned operation involving the removal of a portion of the tarsal cartilage will be necessary to give relief. There are several somewhat differing forms of operation, known by the names of those who have advocated them, which should all be studied, and the one selected that seems best to meet the special requirements of the case.

What is ectropion or ectropium?

An eversion of the lid by which a portion of its conjunctival surface becomes exposed. It may be due to swelling of the conjunctiva, to relaxation of the orbicularis muscle, or to the contraction of a cicatrix involving a part of the lid, or some attached tissue. If from the first cause, reduction of the swelling is all that is required; if from the second, the treatment of the resulting epiphora is sufficient; but cicatricial ectropion often requires a well-planned plastic operation. Of such operations many have been devised, either to bring in adjoining tissue, to bring a flap with a pedicle from a greater distance, or to transplant a piece of skin bodily from some distant part to fill in the space left by dissecting out the cicatrix. Where the tendency to ectropion is but slight, it may be remedied by careful massage of the cicatrix causing it.

What is epicanthus?

A congenital deformity in which there seems to be too much skin for the bridge of the nose, so that it hangs on either side in a fold that overhangs the inner canthus and conceals it. Usually it will disappear entirely as the nose develops; but if not, it may be corrected by removing a piece of skin covering the bridge of the nose.

What is to be done for ecchymosis of the lids?

That from a bruise, that causes a "black eye," may be lessened by the prompt application of ice compresses, or bathing it with some evaporating lotion. Later nothing can be done except to hasten its absorption by bathing with hot water and using massage. The ecchymosis due to bruise is to be distinguished by its immediate appearance, and its seat at the point at which the blow fell, from the ecchymosis due to fracture of the orbit, which only makes its appearance after some days, and is first noticeable and most pronounced in the lids, immediately within the margin of the orbit, and in the oculo-palpebral fold of the conjunctiva, and progresses gradually toward the free margin of the lids.

What is to be done for wounds of the eyelids?

Whenever there is a possibility that a foreign body has entered the wound and remains lodged in it, in the orbit, or neighboring parts, it should be very carefully searched out and removed; and even if nothing is discovered at the time, but there continues a discharging sinus for many days, it should be enlarged by incision and explored with the finger, and in the majority of cases some foreign substance will be found. Lacerated and incised wounds require to be thoroughly cleansed, and their margins accurately retained in proper position by a sufficient number of fine sutures, which are to be removed early. To secure perfect rest for the lids of one eye it is necessary that the other should also be bandaged. Great care should be taken to save every particle of the tissue of the lids possible, and the power of repair in these parts is very great.

Lacrymal Apparatus.

What is epiphora?

The condition of the eye in which the tears accumulate and tend to run over the margin of the lid. Strictly speaking, it should be applied only to the cases in which this occurs from excessive secretion, *stillicidium lacrymarum* being the term to indicate watery eye from interference with the escape of tears through the natural channels.

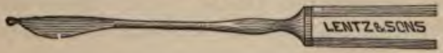
What are the abnormal conditions of the lacrymal gland?

Inflammation, dacryo-adenitis, is very rare. If allowed to discharge through the skin it may leave a fistula. The gland may undergo hypertrophy, or be the starting point of sarcoma. Occasionally, as a congenital peculiarity or from traumatism, it is dislocated from its usual position, where it is concealed by the margin of the orbit, and appears as a more or less movable tumor of the upper lid. It has been extirpated without causing undue dryness of the conjunctiva.

What results from eversion of the punctum?

Normally the punctum is kept in close apposition to the eyeball, and in this position it continually receives the tears, and carries them off, preventing their accumulation. Sometimes as a congenital peculiarity, more frequently from swelling of the conjunctiva, or from senile relaxation of the orbicularis muscle, the punctum gets turned slightly away from the eyeball, and presents directly upward on the free margin of the lid. In this position the tears can only enter it after the eye has filled, and they are commencing to run over the edge of the lid, and a more or less constant watering of the eye results. Sometimes the upper punctum remains in normal position and is able to carry off the secretion except when it is increased, as by exposure to bright light, wind, or dust.

FIG. 27.



What is to be done for eversion of the punctum?

If due to temporary swelling of the conjunctiva, treating that may cure it. Otherwise the canaliculus must be opened from the punctum, well down on the inner side of the lid. To do this little operation cocaine should be used, and a probe-pointed canaliculus knife, Fig. 27, introduced in the punctum, with the cutting edge turned toward the eyeball, and pushed along the canaliculus until a sufficient part of the inner wall of the passage has been divided. The edges of the incision must then be separated each day by traction on the lid, or with a probe until they heal without union.

What is lacrymal obstruction?

The checking of the free passage of the lacrymal secretion through the lacrymal passages into the nose, by swelling of the mucous membrane, by stricture through fibrous thickening of the submucous tissue, or by swelling of the periosteum lining the bony canal from disease of the neighboring bone.

What are the symptoms of lacrymal obstruction?

The eye is constantly full of tears which must be wiped away, or they run over the cheek. Often there is a notable fullness of the region of the inner canthus, and pressure here causes the contents of the lacrymal sac to regurgitate through the puncta. If the obstruction is complete the contents of the sac soon become mucopurulent; and as they are frequently caused to flow out back into the eye they infect the secretion in contact with the conjunctiva, and so set up a conjunctivitis.

What is the treatment for lacrymal obstruction?

Make a free opening into the sac by introducing the canaliculus knife as for everted punctum, but continue the incision by pushing the knife horizontally forward until its probe-point rests against the nasal process of the superior maxillary bone, then elevate the handle of the knife to the vertical to enlarge the incision into the sac. The sac should be thoroughly washed out with a solution of mercuric chloride, injected with a dental syringe, or a hypodermic syringe fitted with a blunt nozzle, until the fluid returns entirely clear. This washing of the sac should be repeated daily until the formation of pus is fairly checked. The effort should also be made to force solutions through the obstructed passage. If this treatment fails to secure a sufficient opening for the free drainage of the sac, recourse may be had to the passage of probes, either commencing with those of moderate size, and increasing their calibre from time to time, until the stricture admits readily one of the larger Bowman's probes; or, first, cutting the stricture by passing a canaliculus knife through it, and immediately following this with the passage of a large probe. The probing must be repeated until the stricture shows no tendency to contract again, allowing the probe to remain in a half-hour or longer at each sitting. Sometimes it is better to allow a soft piece of lead wire to remain in the canal continuously for days or weeks, instead of repeating the probings.

What is abscess of the lacrymal sac?

Dacryo-cystitis is a name applicable to any inflammation of the lacrymal sac; but if the inflammation be violent it involves the neighboring cellular tissue, forming a true abscess, which tends to open through the skin, to become chronic, and leave a lacrymal fistula, which it will be very difficult to heal unless free drainage is secured through the lacrymal canal. Chronic lacrymal fistula that cannot be relieved by other treatment, calls for the ablation of the sac by excision or the destruction of its lining membrane with the stronger caustics.

Diseases of the Conjunctiva.

What are the causes and symptoms of hyperæmia of the conjunctiva?

Foreign bodies, air loaded with dust or smoke, eye-strain, excessive weeping, or the attempt to use the eyes when very tired, will cause burning, smarting, a feeling of "something in the eye," photophobia and the excessive secretion of tears. On inspection the vessels on the inside of the lid are found enlarged and prominent, the tissue between them remaining normally transparent, and sometimes the same condition extends to the vessels on the eyeball, causing the "blood-shot" appearance. Certain constitutional states attended with impaired circulation, as scrofula, may also cause it.

When and how should hyperæmia of the conjunctiva be treated?

If the cause be quite temporary the hyperæmia will disappear with it, in a person otherwise healthy. If the cause is persistent, as in eye-strain from ametropia or presbyopia, it must be carefully sought out and corrected. When there is some underlying dyscrasia, it is often best, in addition to constitutional remedies, to employ local stimulants, as the yellow ointment, or the glycerole of tannin brushed on the inner surface of the lids. To relieve the local sensations of irritation several drops of a solution of boric acid, with or without borax, should be instilled every three hours or oftener. Do not resort to cocaine as a remedy for this condition.

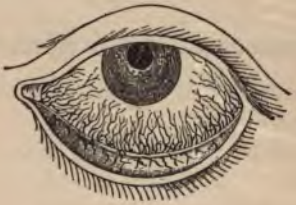
What is the character of the pain of conjunctivitis?

It is of a smarting, scratching, burning character, strictly local, and only accompanied with true aching when there is very considerable swelling of the lids.

Describe the redness of conjunctivitis.

It is generally most pronounced on the inner surface of the lids, becoming less as the conjunctiva passes over on to the globe, and being least near the margin of the cornea. (See Fig. 28.) It is as deep as the hyperæmia is great, in comparison with the amount of exudation into the tissues A proportionately great amount of exudation masking the enlargement of the vessels and causing the surface to appear as pale as the normal, or even paler.

FIG. 28.



Describe the swelling of conjunctivitis.

One of the first effects of exudation into the tissue is the concealment of the separate vessels which are so apparent in the normal conjunctiva. Sometimes, however, when the exudate is excessive, it is itself translucent, having the appearance of jelly, in which a few of the now widely-separated vessels may be seen. The swelling is usually greatest in the lids. Relatively great swelling of the conjunctiva covering the globe is indicative of disease within the globe. An œdema of the ocular conjunctiva, causing it to rise up like a wall around the cornea or to overhang it, is called *chemosis.*

Is there always discharge with conjunctivitis?

Yes; but it may amount to little more than an increase in the amount of epithelium and normal secretion thrown off. A slight discharge often becomes noticeable in the morning, when by accumulating on the lashes all night and drying there, it causes the edges of the lids to adhere, so that there is difficulty in opening them. Even when considerable, it may be so diluted with an excess of lacrymal secretion that its character is not distinguishable. When present in considerable amount it is of muco-purulent character, becoming more purulent as the amount increases. In some cases it is very irritating to the surface of the lids where it comes in contact with them.

What is simple or acute catarrhal conjunctivitis?

An inflammation produced by local irritation, eye-strain, the constitutional conditions that cause acute catarrhs of other mucous membranes, or by infection. It is characterized by conjunctival hyperæmia and moderate exudation, causing some impairment of the transparency of the conjunctiva and some discharge of a muco-purulent character. If not aggravated by poulticing or other improper treatment, or kept up by a persistent cause, it will run its course in a few days to complete recovery. Sometimes it is complicated by the occurrence of superficial ulcers near the margin of the cornea, which alter the distribution of the hyperæmia, and make the pain more severe without changing its character.

How should simple conjunctivitis be treated?

By removal of all irritants, rest of the eyes including sufficient sleep, the careful avoidance of any bandage or other covering that will favor hyperæmia; and frequent instillations of a solution of boric acid and borax. If there is a notable amount of discharge, a solution of mercuric chloride is better, and a one per cent. solution of silver nitrate should be applied to the inner surface of the lids, and the application repeated one or more times on successive days, if necessary.

How do you apply a solution to the inner surface of the lids?

Twist a bit of absorbent cotton around the end of a probe, or better a small stick as a wooden tooth-pick or match, so that while it will adhere to the stick the end is left fluffy. Evert the lid, and having dipped the cotton into the solution, brush the conjunctival surface with it, allowing the patient to look down to expose the upper lid, and up to expose the lower. Before allowing the lids to return to their normal position, the upper lid may be drawn well down, and the lower lid still everted pushed up underneath it as far as possible. In this way the solution may be brought in contact with a portion of the upper lid that is otherwise inaccessible, the lower lid carrying the application to it. If it is designed to have the application of full strength, the cotton is to be used just ready to drop with the solution, but a very much milder application is made by first pressing out all excess of the solution against the side of the bottle.

What is chronic catarrhal conjunctivitis?

Repeated attacks of acute conjunctivitis, especially if neglected, give rise to a permanent condition characterized by thickening of the epithelial layer and swelling of the subconjunctival tissue, the surface may be smooth or may present fine elevations due to swollen papillæ. There is usually a great deal of smarting complained of by old persons, who are particularly liable to this form of disease.

What is the treatment for chronic catarrhal conjunctivitis?

See that the patient is using the best glasses, and if they have heretofore been used only for near vision distance glasses also may be required. Much relief is usually afforded by astringent applications, but nitrate of silver if continuously used for too long a period will discolor the conjunctiva. A smooth crystal of alum may be passed over the surface. Solutions of zinc sulphate are here very useful, also the glycerole of tannin. It is best to vary the application from time to time.

What is vernal conjunctivitis?

A peculiar inflammation of the conjunctiva that comes on with the warm weather in the spring, gets well with the cool weather of autumn, and tends to recur for several years in succession. It affects children, usually involves both eyes, is but little benefited by treatment, and is marked by a thickening of the conjunctiva and its elevation into folds at the corneal margin, while the inner surface of the lids has the appearance of being covered with a thin milky film.

When is a conjunctivitis called purulent?

When it commences with great swelling of the lids and chemosis, and after one or two days a free purulent discharge is set up, which continues for some weeks, while the swelling gradually lessens. It is usually due to infection, and when it can be directly traced to a case of gonorrhœa, it is called *gonorrhœal ophthalmia*. The great danger of the disease is from involvement and partial destruction of the cornea. It tends ultimately toward complete recovery, but requires a month or more to run its course; and may leave a chronic condition of hyperæmia with enormous enlargement of the conjunctival papillæ.

How should purulent conjunctivitis be treated?

First secure strict cleanliness of the conjunctiva by thoroughly washing it every hour, preferably with a solution of mercuric chloride. This must be forced between the closed lids with a glass or hard rubber syringe, or forcible expulsion from a large pipette, in quantity sufficient to remove all conjunctival discharge. Once daily an application of a solution of silver nitrate, of the strength of two per cent. or upward, should be made to the everted lids, or if the swelling and discharge are very great, this should be dropped into the eye and by manipulation carried to all parts of the conjunctival sac. To avoid serious involvement of the cornea the eye should be bathed with very hot water for a few minutes every few hours. At the height of the attack the patient had better remain in bed, and take full tonic doses of tincture of iron and quinine. If but one eye is affected, use every precaution to keep the discharge from reaching the other.

What is ophthalmia neonatorum?

A purulent conjunctivitis of early infancy due to infection of the eyes at birth, though often attracting but little attention for the first few days. It is the most common cause of life-long irremediable blindness, through perforation and resulting opacity of the cornea. The discharge glues together the edges of the lids, preventing its own escape, until the conjunctival sac becomes enormously distended with it; and, soaking day after day in this mass of infectious pus, the cornea is apt to become softened and give way. Still, the cornea at this age has great resisting and reparative power, and with the aid of active treatment can almost always be saved if it have not already given way before such treatment is instituted.

What is the treatment of ophthalmia neonatorum?

For preventive, drop a two per cent. solution of silver nitrate into the eyes of every child born of a mother known to have suffered with gonorrhœa, or having a suspicious vaginal discharge. If the disease be established, follow out the local treatment given for purulent ophthalmia with the greatest care, making sure that each application and cleansing is thorough.

What is croupous conjunctivitis?

A purulent conjunctivitis in which a part of the exudation remains slightly adherent to the conjunctival surface, whence its separation is not difficult but may cause some bleeding. The grayish mass gives the name to this form. It requires no peculiar treatment except perhaps the freer use of hot applications and the systemic remedies.

What characterizes diphtheritic conjunctivitis?

A firm, fibrous exudation, not to be detached from the surface of the conjunctiva, but partially within the tissue of the lids, which are greatly swollen, stiff and brawny, this condition lasting some days and giving place to those of an ordinary purulent conjunctivitis. The cornea is generally destroyed, and there may be cicatricial contraction of the lids. It is to be treated as a croupous conjunctivitis, but with more nearly continuous use of hot applications, and the avoidance of caustics in the early stages. It is not common in this country.

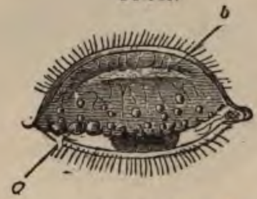
What is granular conjunctivitis?

It is a specific inflammation, arising by infection, running on in many cases indefinitely, marked by the appearance of translucent granules beneath the conjunctival surface, most numerous in the retrotarsal folds. These granules are composed at first of leucocytes, but later become organized into firm fibrous tissue. Their appearance is aptly compared to that of sago grains. They are much larger and deeper than the slight elevations of surface often seen in catarrhal conjunctivitis, due to swelling of the papillæ, and which are popularly spoken of as "granular lids." They are also to be distinguished from those deep red, soft, papillary granulations left by poorly treated purulent conjunctivitis. In this affection the cornea is threatened, not with perforation, but with permanent opacity from pannus, and there is scarcely any tendency to spontaneous recovery, and the lids are always left the worse for cicatricial contractions.

How is granular conjunctivitis to be treated?

The destruction of the individual granulations may be attempted where they are prominent, either by crushing with forceps made for the purpose, by electrolysis, by the galvano-cautery, or by incising each separate granulation and expelling its contents by pressure. In addition to the foregoing, or where it is not necessary, strong astringent applications should be made to the conjunctiva daily for this purpose; the copper crystal and the glycerole of tannin are the most valuable; but they require to be varied with others, such as silver nitrate, alum crystal and solutions of zinc sulphate. The mercuric chloride solution should also be used three or four times a day to cleanse the conjunctival sac. Great care should be taken to avoid the infection of the second eye where one only is affected, or the infection of the eyes of other persons with whom the patient comes in contact. The treatment, too, must be persistently carried out for a long time, sometimes many months, or even years, until the disease is eradicated; or its suspension will be followed by the relapse and the indefinite continuance of the disease. Even with proper treatment, a return to the original normal condition of the lids cannot be expected, for some cicatricial shrinking of the conjunctiva, and often of the deeper tissues of the lid, must be expected. Frequently, too,

FIG. 29.



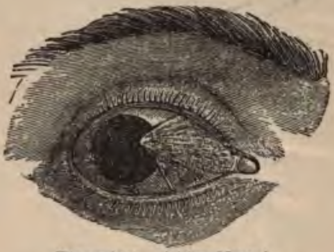
A true granular lid. (*After Nettleship.*)

the disease leads to pannus, and may require the special treatment referred to under that head.

What is pterygium?

A triangular thickening and extension of the conjunctiva and subconjunctival tissue on the cornea. (See Fig. 30.) The apex of the triangle is toward the centre of the cornea, the base usually toward the inner canthus, sometimes toward the outer canthus, and very rarely in other directions. It is most common in warm countries. It continues for a certain time progressive, and then may remain stationary for an indefinite period. It is unsightly, and may impair vision by encroaching on the space of the pupil, or by causing astigmatism.

FIG. 30.



Pterygium. (*After Meyer.*)

What is to be done for pterygium?

If not extending its area upon the cornea it may be left undisturbed, but if the corneal portion be increasing it should be removed. To do this, seize the apex with strabismus forceps and draw upon it, then with a knife separate the overlying tissue from the clear cornea, being careful to remove it all, leaving nothing but the transparent corneal tissue. Continue the incision until the extra-corneal part of the pterygium is also separated from the sclera for some distance back from the corneal margin. The mass thus isolated may be disposed of by turning under, by putting a suture through its apex and bringing both ends beneath the conjunctiva, and out near the caruncle, where they are to be tied; or by transplantation, by making an incision from the lower border of the pterygium below the lower margin of the cornea, and fixing the corneal portion of the growth in this position by a suture; or by excision by a couple of snips with the scissors, starting from the cornea at the margins of the pterygium and converging until they meet near the caruncle. Pterygium often shows a tendency to return after removal, and repeated excisions are not without some risk of causing a limitation of the movements of the eye, and diplopia through the formation of a rigid cicatrix.

What is pinguecula?

A yellowish thickening of the conjunctiva and subconjunctival tissue at the inner margin, or rarely the outer, of the cornea. When inflamed, it may be quite prominent; and if annoying to the patient may be excised. It has no tendency to spread upon the cornea or to prove otherwise injurious.

What are Meibomiam concretions?

Masses of the secretion of these glands which have generally become calcareous. They appear as yellowish-white spots of the size of a pin-head beneath the conjunctiva of the lids. When they give rise to irritation they should be removed.

What other morbid conditions affect the conjunctiva?

Amyloid degeneration, usually affects the inner surface of the lid, causing a pale waxy appearance and considerable thickening. It is a strictly local process, the tissue involved may be removed by scraping. In *xerosis*, a sequel to severe granular or diphtheritic inflammation, the conjunctiva becomes contracted and dry with gray scales on the surface. *Dermoid tumors* are usually situated at the margin of the cornea, or partially upon it. They are smooth, of a yellowish color, resemble the skin in structure, and sometimes present fine hairs growing from the surface; they require removal. *Simple polypus*, *lupus*, *epithelioma* and *syphilitic ulcers*, both secondary and primary, occur upon the conjunctiva. Subconjunctival ecchymosis is apt to be produced by the rupture of a vessel during coughing or vomiting, especially in whooping cough. The time required for its absorption depends on the amount of effusion.

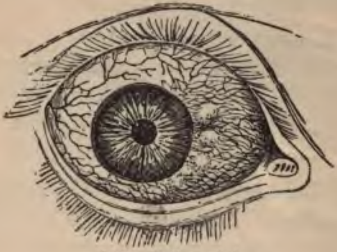
What is phlyctenular or strumous ophthalmia?

An inflammation always involving the conjunctiva, and often the cornea, dependent largely on a certain constitutional condition, occurring usually in children presenting repeated exacerbations or attacks, which tend to rather speedy recovery, but which may in the end leave the cornea seriously damaged, and which are characterized by the appearance of phlyctenulæ, usually at the corneal margin or limbus of the conjunctiva, or upon the cornea.

Describe a phlyctenula.

On the conjunctiva it appears suddenly, that is in a few hours' time, as an elevated patch from one to three millimetres in diameter, which after a day or two has an abraded surface, but which continues elevated throughout. (See Fig. 31.) It gradually subsides after a few days, being followed by a complete restoration of the part to its normal appearance. On the cornea it begins as a minute elevation of the surface epithelium, which is soon lost, allowing the escape of a drop of fluid, and the ulcer so formed slowly heals, leaving a gray cicatrix that becomes more like normal corneal tissue as the child grows older, and may become quite imperceptible, except by its interference with the proper refraction of light.

FIG. 31.



(After Dalrymple.)

Describe the hyperæmia of phlyctenular ophthalmia.

When the conjunctiva alone is the seat of phlyctenulæ, only the conjunctival vessels are involved, and mainly those running to the particular part or parts where the phlyctenulæ are seated. This causes the white of the eye to be reddened in one or in certain directions, while other radiating sectors may have the normal color. If one is seated near the margin of the cornea, there will be a pink zone of hyperæmia of the deep vessels, but it will be mainly or entirely confined to that side of the cornea. If the phlyctenula be at the centre, or if there be several on various parts of the cornea, the pericorneal zone will extend all round. This hyperæmia of the surface of the globe is so obvious that it cannot escape notice; it becomes very marked with each fresh eruption of phlyctenulæ and quickly fades away again; but there will also be found a hyperæmia of the inner surface of the lids, which is worse during the attacks, but which persists during the intervals, and requires that the local treatment for it be kept up until it is completely cured, if immunity is to be had from future exacerbations of the disease.

What are the other symptoms of a phlyctenular attack?

There is much of the usual smarting, burning pain of a conjunctivitis, and in many cases, especially those involving the cornea, a very strong inclination to keep the lids tightly closed. This is spoken of as photophobia, but it is not a simple dread of light. Primarily it is more a dread of having the cornea exposed to the air; and the eyes will be as tightly closed, and the head buried in the pillow in complete darkness as in ordinary light. When, however, the exclusion of light has been permitted for a few days, a true photophobia is added. The spasmodic closure of the lids is probably due to the corneal lesion, but it may be increased or continued by an abrasion or fissure of the skin at the outer canthus, which is brought about by the continuous overflow of tears at this point that goes on when the lids are kept violently pressed together, and which, when once formed, may act as a source of reflex irritation. Excessive lacrymation is a symptom generally present, and the slight increase of mucous secretion is so diluted and washed away as not to be recognizable.

How should phlyctenular ophthalmia be treated?

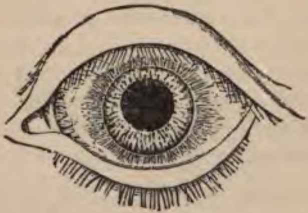
Strict attention should be paid to general hygiene, especially to secure outdoor life a considerable part of each day, the prevention of constipation, and the careful regulation of diet. It is often necessary to instruct parents as to the harm of the free use of tea and coffee, the taking of sweets between meals, and the inability of the stomach of a delicate child to deal with certain foods. Of general tonics, preparations of the iodide and chloride of iron are most valuable. Locally, anything like a poultice or bandage must be strictly avoided. It is sometimes worth while to order the use of dark glasses to prevent the constant rubbing and wiping of the eye. The strong astringents, like silver, zinc and tannin, are only to be used for lightly brushing the inner surface of the lids. The ointment of the yellow oxide of mercury should be used once a day. If the cornea be much involved, atropia instillations will lessen the irritability. Treatment should not be intermitted in the interval between the attacks, but continued until the liability to them is quite removed. Opacities of the cornea are to be treated after methods to be presently described.

Diseases of the Cornea.

What hyperæmia attends inflammation of the cornea?

The blood-vessels on which the nutrition of the cornea depends being situated, not in its substance, but in a zone around it, the hyperæmia manifests itself in this zone. Normally these vessels are quite invisible, but when the cornea is inflamed their enlargement causes the appearance of a pink or rose-colored zone, most deeply colored at the corneal margin, and shading off gradually into the white sclerotic (see Fig. 32). This may be of equal width all around the cornea, or may be narrower or quite absent at some parts of the corneal circumference. The same pericorneal zone is seen in iritis and in inflammation of the ciliary body. It is to be carefully distinguished from the redness due to conjunctivitis, which is deepest where the conjunctiva passes over from the lids on to the eyeball, and may fade out entirely toward the cornea, and which

FIG. 32.



involves the superficial vessels. It should be remembered that the two kinds of hyperæmia not infrequently co-exist.

What are the other symptoms of keratitis?

The pain may be either of the burning or smarting character experienced in conjunctivitis, or it may be an aching, or both kinds may be felt. There is also dread of exposure to the light and air, and excessive lacrymation. The cornea to a greater or less extent loses its transparency by infiltration, causing obscuration of the red reflex from the fundus, as seen with the ophthalmoscope, a gray or translucent appearance by oblique illumination; and hiding or apparent altering of the color of the iris as seen through it. The surface of the cornea may also lose its normal regularity, either by loss of substance forming an ulcer, or by cicatricial contraction drawing it out of shape.

What is a simple or non-suppurating corneal ulcer?

The condition produced by the loss of a portion of the epithelium and deeper true corneal tissue. It is best recognized by examining the reflection of a window or a lamp flame, given by the cornea, and moving the point of view, or the light, or the eye under inspection, so that the reflection shall be successively received from all different parts of it. While the ulcer is increasing the tissue about it may remain almost entirely transparent, but more commonly is somewhat gray, but as the loss of tissue is repaired by tissue that is not transparent, the process of healing gives rise to considerable opacity, which afterward slowly lessens as the reparative tissue becomes more or less completely transformed into true corneal tissue.

What are the causes of corneal ulcer?

Direct injury, conjunctivitis, disease or injury involving the ophthalmic branch of the trifacial nerve, and constitutional states of impaired nutrition, as old age, starvation, exhausting fevers and malarial poisoning.

What are the peculiarities of the corneal ulcer occurring with herpes zoster ophthalmicus?

It appears during or after the height of an attack of ophthalmic or frontal herpes or zona; often confounded with erysipelas on account of the swelling and violence of the inflammation. It is almost certain to occur if the skin of the nose is affected. It is usually complicated by interstitial inflammation of the cornea and of the iris. It runs a slow course and is not helped by active local treatment. In this and in neuro-paralytic keratitis the sensitiveness of the cornea to touch is subnormal.

What are the characteristics of the malarial ulcer?

It occurs in patients that have otherwise manifested malarial poisoning, is superficial, has the shape of an irregularly branching line, and requires a regular anti-malarial treatment.

What is the treatment for simple ulcer of the cornea?

When due to conjunctivitis, either acute or chronic, it is essentially the treatment of the conjunctivitis. In so far as it is due to impairment of general nutrition, constitutional treatment is required, as rest in bed, good food and tonics. In such cases, and in those due to nerve disease, neuro-paralytic and herpetic, the cornea must be protected from injurious influences, and healing must be favored by local warmth. To this end the eye may be covered with a thin bandage, which must be kept from becoming damp, so that it would act as a poultice, or dry heat may from time to time be applied, or the eye occasionally bathed for a few minutes with water as hot as can be borne. Atropine, or eserine which has a similar power of stimulating the nutrition of the cornea, may be instilled from one to four times a day. Strong astringents are to be avoided, except as they are indicated for the treatment of a causative conjunctivitis.

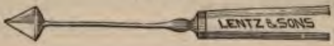
What happens when an ulcer perforates the cornea?

The aqueous humor escapes, and the lens and iris are pressed forward against the cornea, the pupil immediately contracting, so that usually it is the iris that is in immediate contact with the point of perforation. Lymph is then effused upon the iris and with it closes the opening, and the aqueous reaccumulates. After this, if the perforation is very small the iris may, with the help of atropine for a central, or eserine for a peripheral perforation, be dragged away from the cornea. This is the best result possible. If the iris remains incorporated with the lymph that goes to make up the cicatrix, a permanent *anterior synechia* is formed. When the area of the perforation is large, as soon as the escape of aqueous ceases with *the plugging* of the perforation with iris and lymph, this plug bulges forward and tends to drag more iris into the opening, causing an *anterior staphyloma*, that tends to increase.

How should perforating ulcer be treated?

When threatened, the cornea should be tapped as a preventive, not through the bottom of the ulcer, but through some other portion. The operation is done by passing the point of a cataract knife or a paracentesis needle (Fig. 33) obliquely through the cornea, then rotating it so that it will spread the lips of the wound and allow the aqueous to drain slowly away, and then withdrawing the knife, taking especial care that the point shall at no time touch the capsule of the lens. To perform this cocaine may be used, but repeated applications of it should be avoided in all simple corneal ulcers. If perforation has occurred, strong solutions of eserine or atropine may be used to drag the iris loose; but if the cicatrix holds the iris and bulges with it, it should be excised, either by a single snip with the scissors, or by transfixing with a cataract knife and shaving off one side and completing the removal with scissors. This operation must be repeated as often as the remaining cicatrix bulges, to secure parts of the cornea not involved in the ulcer from subsequent damage by increase of the staphyloma.

FIG. 33.



What is suppurating ulcer of the cornea?

An ulcer the base and margins of which are of a yellowish gray from purulent infiltration, and which tends to extend in one or more directions by the breaking down or sloughing of this infiltrated tissue. Its peculiar character and tendency are due to pyogenic infection. It may arise either from a simple ulcer, or as a point of infection, or from an abscess. It tends strongly to perforation and may lead to suppuration of the deeper tissues and functional destruction of the eyeball.

How should suppurating ulcer of the cornea be treated?

All softened tissue should be carefully scraped away with the corneal spud, the operator at the same time pressing out most of the infiltration from the tissue adjoining it. The ulcer is then to be thoroughly washed with a strong solution of mercuric chloride, and instillations of a weaker solution practiced at intervals of an hour or more, and the scraping and washing with the strong solution repeated daily until the ulcer loses its tendency to suppuration ; then treat it as a simple ulcer. The disinfection of the ulcer, and removal of dead tissue, may be accomplished by the use of the actual cautery, or galvano-cautery, but these cause a greater destruction of tissue than is necessary, and hence a larger scar.

What is abscess of the cornea?

A circumscribed collection of pus within the cornea. It tends to increase by the involvement of neighboring tissue until it finds an outlet. It causes a yellowish opacity beneath the surface of the cornea. In rare cases the pus does not find an outlet, but remains to undergo caseation, giving rise to a permanent opacity of the cornea, which may also be a permanent menace of future inflammation and ultimate loss of the eye.

What is the treatment for corneal abscess?

Open it freely. This may require a crucial incision or even the removal of some of the overlying tissue. Then treat it as a suppurating ulcer.

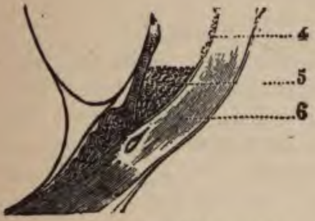
What are onyx and hypopyon?

Onyx is an accumulation of pus between the layers of the cornea, near its lower margin. (See 6, in Fig. 34.) It is opaque, the color of pus, and its upper margin is nearly or quite horizontal. It appears in connection with abscess or suppurating ulcer of the cornea. *Hypopyon* has a similar appearance, but it is a collection of pus at the bottom of the anterior chamber. (See 5, in Fig. 34.) On changing the position of the eye, it is more apt to be displaced than onyx. Close inspection and the use of oblique illumination, will reveal the position of the accumulation. Hypopyon arises from suppuration of the iris or other deep structures of the eye.

What is interstitial keratitis?

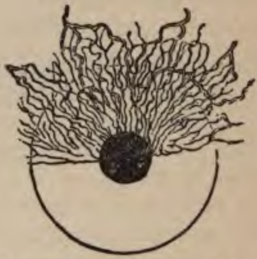
A chronic inflammation of the true substance of the cornea, leading through exudation to opacity of that membrane. The opacity begins near the margin of the cornea, spreads toward the centre, and begins to clear up first at the margin. There is a zone of pericorneal hyperæmia when the inflammation is at its height, and even when this seems, at first glance, to be absent, it is often very readily provoked by exposure to light, or touching the eye. In some cases the cornea itself becomes vascular, the vessels being quite fine and lying deep in the tissue. From three weeks to as many years are required for the disease to run its course. It is frequently attended by inflammation of the iris and deeper parts of the eye. Its most frequent cause is inherited syphilis, but it may depend on other causes of malnutrition. When due to the former cause it is generally accompanied by the deformity of the teeth known as Hutchinson teeth.

FIG. 34.



4. The posterior keratitis punctata.
5. Hypopyon.
6. Onyx. (*After Meyer.*)

FIG. 35.



Pannus of the upper part of the cornea. (*After Nettleship.*)

When the disease has completed its course there is almost always considerable clearing up of the cornea, and in young children a complete restoration may follow great opacity.

What is the treatment of interstitial keratitis?

Locally, irritants are to be avoided, the pupil should be kept well dilated with atropia and the eye bathed once or twice daily with hot water, until the stage of hyperæmia and irritability is past. After this installations of calomel, or the application of the ointment of the yellow oxide of mercury, may be resorted to, to hasten the absorption of the opacity. The constitutional treatment must be such as to quicken nutritive processes, plenty of exercise, fresh air, good food, preparations of iron, and small or moderate doses of potassium iodide, with small doses of mercuric chloride. Even when due to syphilis the disease does not yield any more promptly to more active specific treatment.

What is pannus?

A vascular opacity of the cornea, due to chronic conjunctivitis, and affecting mainly the portions of the cornea that come most constantly in contact with the lids. Sometimes it is sharply confined to the portion of the cornea that comes in contact with one lid, in other cases the whole cornea is more or less involved. The opacity lies closely beneath the corneal surface, only exceptionally affecting the deeper layers; and the vessels in it come off from the conjunctival vessels, often including quite large branches. The pannus grows better or worse with the conjunctivitis causing it, and with it tends to continue indefinitely if not treated.

What treatment should be adopted for pannus?

The treatment of the conjunctivitis causing it. When the pannus is general, and the whole cornea supplied with blood-vessels, there is very little danger of the perforation of the cornea by ulceration, and it becomes practicable to treat the conjunctivitis by methods that would at other times be unjustifiable. One of these is to cut short a chronic granular, by an acute purulent conjunctivitis, produced either by the *inoculation* of purulent discharge in the conjunctival sac, or by repeated brushing the everted lids with an infusion of *jequirity.* When a vascular opacity persists after the cure of the conjunctivitis which caused it, *peritomy*, may be resorted to. In this operation an incision is made parallel to the corneal margin, and three to five millimetres from it, and the conjunctiva and subconjunctival tissue included between it and the corneal margin thoroughly removed. This is done around so much of the corneal margin as furnishes vessels to the cornea. Another method of treating such cases is with the spud or other similar instrument, to scrape away the opacity from the cornea until only transparent tissue is left, repeating the operation, if necessary.

What are the different kinds of opacities of the cornea?

A very faint opacity, scarcely perceptible unless looked for by oblique illumination, is called a *nebula.* A spot of perceptible but not complete opacity is spoken of as a *macula*, and one that is densely opaque and usually of a white color is called a *leucoma*. Ulcers of the cornea cause these various opacities according to their depth, leucoma being left by an ulcer that has destroyed most of the thickness of the cornea. When the leucoma is the cicatrix of a perforating ulcer, and has still a portion of the iris embedded in it, it is called an *adherent leucoma*. Occasionally, minute dots of opacity are found scattered through the cornea as a congenital defect. There is also a form of opacity that affects eyes that have been lost by previous inflammation; and sometimes, in old people, eyes previously healthy. It consists in a film of calcareous matter deposited just beneath the epithelium in the band of cornea that is habitually exposed to the air by the opening of the lids.

What may be done for corneal opacities?

The period of absorption and resolution after the formation of an inflammatory opacity of the cornea may be prolonged, and rendered more effective in the removal of the opacity, by the occasional use of mild irritant applications to the cornea, such as instillations of calomel, or the application of the ointment of the yellow oxide of mercury, also by repeated bathing of the eye with hot water. Where a leucoma hides the pupil while other parts of the cornea are clear, an iridectomy may be done to give a clear pupil, though the result of such an operation is rarely any great improvement in vision. Band-like opacity may be scraped off, and other opacities are sometimes rendered less dense by the operative removal of the opaque tissue. Transplantation of the rabbit's cornea may be done where the opacity does not involve the whole thickness of the cornea. Tattooing with India ink renders leucoma less of a deformity.

What is staphyloma of the cornea?

The bulging of a cicatrix following corneal ulcer. It may occur where the cornea has not been perforated, but only greatly weakened; but mostly it is a cicatrix involving the iris. The incorporation of the iris with the cicatrix causes an increase of the tension of the eyeball, which often leads to the distention of the whole globe, but more especially of the comparatively weak cicatrix. In the process of distention the iris may be more and more drawn into contact with the cornea until it is all involved, the partial staphyloma becoming total. In some cases the prominence of the globe is so great that the lids cannot be closed over it, and the exposure causes a constant inflammation of the part.

What is to be done for staphyloma?

When but partial, some of the cornea remaining clear, an iridectomy should be done if it shows any tendency to increase, or there is high tension of the globe. When the bulging of a total staphyloma is excessive the cornea lens and ciliary body may be removed, by the operation of *abscission*, or the whole eyeball may be excised.

What are conical cornea and kerato-globus?

By exhausting constitutional disease the cornea may be so softened that, without previous thinning by ulceration, it yields before the tension of the contents of the globe. When the yielding is mainly at one point, the cornea comes to assume a somewhat conoidal shape, and the affection is called *conical cornea*. When the yielding is more uniformly distributed, the enlargement is spoken of as *kerato-globus*.

What is arcus senilis?

A gray arc a little distance within the upper and lower margins of the cornea, which gradually becomes more dense and extends until it forms a complete circle. It is due to a fatty change in the cornea, is usually seen in old people, but sometimes occurs in childhood. It is of very little practical value as an indication of fatty degeneration in other parts of the body, and does not constitute any serious contra-indication to corneal operations.

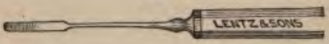
How do you recognize the presence of a foreign body in the cornea?

A foreign body may become embedded in the cornea without being noticed, and if it does not project so as to scratch the conjunctiva of the lid, may cause no discomfort for some hours or days, at the end of which time the eye will get sore, and redness will develop in the pericorneal region. The part of this region reddened is the part nearest the foreign body. By oblique illumination foreign bodies of light color are seen against the black pupil, and those of dark color become visible against the lighter iris. In searching for them the eye should be turned in different directions so as to bring each part of the cornea before each kind of background. Very small foreign bodies may be located by viewing the eye from a few inches distance with the ophthalmoscope when they appear as black dots against the red background of fundus reflex.

What is to be done for foreign body in the cornea?

Remove it as soon as possible. In most cases it is only necessary to put a drop of cocaine solution on the cornea, and press it out from its bed with the blunt corneal spud, such as is shown in Fig. 36. When very deeply embedded, it may be necessary to cut it loose with a corneal needle. If from long retention the eye has become violently inflamed it may be necessary to give ether, but by retention the corneal tissue around the body becomes softened, and it can often be removed without force or the causing of any pain. Particles containing iron often leave a brown stain of the tissue around them, which it is not essential to remove.

FIG. 36.



What is to be done for a wound of the cornea?

Cleanse it and keep the eye closed for a very few days, until it is united, carefully avoiding anything that may act as a poultice. Bruises may lead to subsequent sloughing of the cornea. A burn may cause an extensive dense white opacity, which soon separates, leaving clear cornea that may be quickly and completely restored to a normal condition.

Diseases of the Sclerotic.

What is scleritis?

An inflammation of the sclerotic coat, showing itself in purplish patches of deep hyperæmia, running a very chronic course, like inflammations in other dense fibrous tissues, ending in complete resolution, though sometimes not until the softening of the coat has lead to a local bulging or staphyloma, and sometimes as one patch gets well another is affected, so that it is continued for months or years. It is dependent on constitutional conditions, especially rheumatism, and requires constitutional treatment. Locally, all irritants are to be avoided, atropia instilled, and the eye bathed occasionally with hot water, and the eyeball subjected, through the closed lids, to gentle but systematic massage.

What is rupture of the sclerotic?

Bruise of the eyeball, without serious injury to the conjunctiva, may cause the sclera to rupture near the margin of the cornea, with the extrusion of a portion of its contents, as the iris or lens. Such injury, as well as an incised wound, is liable to cause hemorrhage within the eyeball. It is to be treated by rest, and sometimes the removal of the extruded contents from beneath the conjunctiva.

Diseases of the Iris.

What are the evidences of hyperæmia of the iris?

A zone of pericorneal redness, just like that seen in keratitis, contraction and sluggishness of the pupil, and thickening and discoloration of the iris itself. The discoloration is scarcely noticeable in certain brown eyes, but in eyes normally gray or blue it causes a greenish hue that is quite different from the normal appearance. Change of color in the iris may also be caused by discoloration in the cornea or aqueous humor. Very pronounced hyperæmia is always to be regarded as indicating actual inflammation of the iris, but sometimes iritis occurs without hyperæmia that has attracted the attention of the patient.

What are the subjective symptoms of iritis?

Pain, of an aching or neuralgic character, located in and about the eye, often referred to the brow or side of the nose, is generally present and severe. It is liable to exacerbations, especially at night, in which it is but partially relieved by morphine. In some cases pain is quite absent. The eyes are irritable; the discomfort or pain is increased by attempts to use it or on exposure to light. Vision is usually imperfect, from clouding of the media by exudate.

What are the effects of exudation in iritis?

The iris is thickened, and its normal retraction toward the periphery, which causes the normal dilatation of the pupil, is *prevented.* This may be the case for all parts of the iris equally, or it may be confined to certain segments of the iris, when the thickening of these parts is more noticeable, and the dilatation of the pupil irregular. The common cause of irregularities of the pupil is the adhesion of some part of the iris to the lens capsule. When the pupil is contracted, the iris near its margin rests upon the capsule of the lens. If in this position, any plastic exudate upon its posterior surface glues it fast to the lens. At first the wide dilatation of the pupil by atropine is able to tear loose these adhesions and liberate the iris; later it may stretch them and thus secure some additional freedom of motion, but after a time they become organized, and mydriatics have little power over them.

How would you look for irregularity of the pupil?

Commonly, at first the pupillary margin of the iris becomes adherent at scattered points only, at which the iris remains bound down while other parts of the pupil dilate, and thus the pupil becomes irregular. Remember that the irregularity is only shown, or best shown under conditions that conduce to the dilatation of the pupil. In strong light looking at a near object, the pupil may be perfectly regular, when by the use of a mydriatic, or even in a dim light or by relaxing the convergence, it is shown to be very irregular. Fig. 37 represents the irregular dilatation of the pupil by a mydriatic in iritis.

What is exclusion of the pupil?

The binding down of the whole margin of the iris to the lens, so that there is no communication between the space back of the iris and the anterior chamber, the pupil itself, however, remaining clear.

What is occlusion of the pupil?

The pupil itself is filled with lymph, preventing any useful vision. In addition to this the whole posterior surface of the iris may be fastened to the lens by the great quantity of plastic exudate.

What is keratitis punctata?

An opacity of the cornea produced by dots of exudate on its posterior surface. (See Fig. 34.) These dots of opacity are usually distributed over a triangular area, as shown in Fig. 38. They are sometimes very fine, but may be so abundant as to run together, forming masses, especially at the lower part of the cornea. Commonly they entirely disappear within a few weeks or months after recovery from the iritis that causes them.

What is serous iritis?

Inflammation of the iris in which the serous element in the exudate so preponderates over the plastic that it does not accumulate in the iris or upon its surface sufficiently to cause any adhesion to the lens capsule. But it always causes keratitis punctata. Cases of iritis, in the main serous, often cause one or two slight adhesions.

What is plastic iritis?

The most common form; usually attended with pain, and redness around the cornea, and running an acute course in a few weeks, with or without adhesions, according to the violence of the attack and the efficiency of the treatment. Sometimes it is more chronic, lasting months with repeated exacerbations; or it may be comparatively free from pain and redness, so that firm adhesions occur very insidiously. The latter is apt to be the case in debilitated persons, as with old people. Sometimes the whole anterior chamber is filled with plastic exudate; such a case is called one of *spongy iritis.*

FIG. 37.

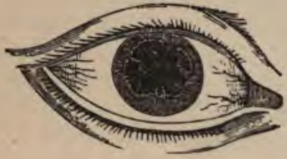
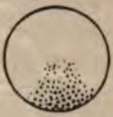


FIG. 38.



What is parenchymatous iritis?

A form characterized by great swelling of the iris itself, and apt to leave some permanent changes in parts of its tissue. Purulent iritis is often included under this head; it is apt to occur with purulent inflammation of other parts of the eye as purulent keratitis. It may cause hypopyon, or the pus may be carried off without accumu- *ing* in the anterior chamber.

What is syphilitic iritis?

An attack occurring, as it very frequently does, as one of the secondary manifestations of syphilis. Generally both eyes are affected, though to a different extent, while in iritis from other causes but one eye is apt to suffer. Gout and rheumatism also predispose to bilateral iritis. Syphilitic iritis runs a slow course; though it often begins in the serous form it later becomes plastic. In gout the inflammation is apt to be latent or insidious in its character. In rheumatism it is plastic and severe.

What is gumma of the iris?

A localized swelling of the iris coming on after an attack of syphilitic iritis, forming a small, rounded, yellowish tumor. It is really a kind of parenchymatous iritis. Under active anti-syphilitic treatment it commonly disappears, leaving a distinct cicatrix or atrophied patch in the iris.

How should mydriatics be used for iritis?

Place the pupil under the influence of a strong mydriatic, as atropine, as soon as possible. This will not be especially difficult to do in serous iritis, but in severe plastic, or parenchymatous iritis, the drug must be used vigorously. A strong solution should be placed at the upper portion of the cornea every five minutes for a half-hour, or until the pupil is well dilated. To avoid any danger of atropia poisoning, the lacrymal puncta should be kept everted during this time by pressing the finger against the side of the nose in such a way as to draw on the skin of the lids near the inner canthus. The keeping of the solution from reaching the mucous surfaces of the nose and throat is made more certain by holding in contact with the puncta a bit of absorbent cotton. After the pupil is once dilated it must be kept so by instillations of the mydriatic, repeated every few hours. As the eye gets better the drug may be used less frequently, but it should be continued at least twice a day until the eye is quite free from pain or redness.

What other local treatment does iritis require?

Bathe the eye with very hot water for a few minutes at a time once daily or oftener. This may be done just before the instillation of the atropin. This will be found one of the best means to relieve pain. But it must not be used very long at a time or very frequently repeated. In bringing the eye under the influence of the mydriatic at the start, cocaine instillations will be found of help, but after that they should not be repeated. The eye should be shielded from bright light. The wearing of dark glasses is usually sufficient after the violence of the inflammatory process has passed its maximum; and a bandage, that might act as a poultice, is always to be avoided. In very violent hyperæmia it may be worth while to resort to leeching of the temple.

What is the general treatment for iritis?

In the early stage of acute iritis, complete rest, with the head elevated, is of great importance. At the same time a mild purge, or such action as may be had from the use of calomel, is good; the mercurial exerting a beneficial influence on the plastic exudate, whatever the cause of the iritis. If syphilis, rheumatism or gout be actually present, it should be actively treated. Many of the worst cases of iritis occur in anæmic and cachectic patients, to whom good food, avoidance of exposure, and the use of tincture of iron are a very important part of the treatment. Quinine, in moderate doses, is beneficial in nearly all cases.

What are the common sequelæ of iritis?

Adhesion of the iris to the lens capsule, called *posterior synechia.* This may be partial, causing the iris to be dragged upon in certain directions when the pupil should dilate, and in some cases rendering the iris unhealthy and liable to new attacks of inflammation; or it may be complete, checking the normal flow of aqueous through the pupil, causing it to push the iris forward, ballooning the iris (see Fig. 39), or even when the lens and iris are firmly united over a large surface pressing the lens forward, and causing a secondary glaucoma. In some cases iritis leaves a myopia, usually temporary. Occlusion of the pupil when it occurs is apt to be permanent.

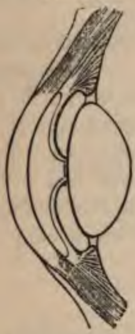
How are the sequelæ of iritis to be treated?

Mainly by prevention, by active intelligent treatment in the early stages of the disease. If this has not been successful, something may be accomplished by the division of adhesions, when there seems to be a tendency to repetitions of the first attack. Iridectomy may be done if the adhesions have been extensive, and is urgently indicated for exclusion of the pupil and bulging of the iris; occlusion may also require extraction of the lens. Myopia may require glasses for its correction, which will need to be changed or discarded if the myopia subsequently diminishes.

Describe the operation of iridectomy.

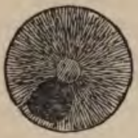
It is the excision of a portion of the iris. To do it an incision is made in the margin of the cornea nearest the part of the iris to be removed, then if the iris is not washed out by the escape of aqueous, a pair of fine iris forceps or an iris hook is introduced and the part of the iris to be excised pulled outside the corneal incision and cut off. Then the stump is carefully returned within the anterior chamber, permitting none of it to remain in the corneal incision, and the eye kept closed until the corneal incision has united.

FIG. 39.



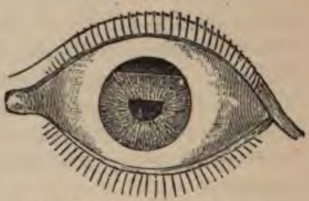
(*After Nettleship.*)

FIG. 40.



Artificial pupil, after occlusion of the natural pupil.

FIG. 41.



Iridodialysis. (*After Swanzy.*)

What other operations are done on the iris?

Iridotomy, incision of the iris, when it is desired to make an artificial pupil, and the iris is held so much on a stretch that a simple incision will gap sufficiently without the removal of any tissue. *Iridodesis*, drawing the pupil into a new shape and position, is accomplished by making a small incision in the cornea, and drawing a part of the iris, including some of the pupillary border, into it, and fixing it and strangulating it there with a ligature.

What new growths appear in the iris?

Cysts form in it, varying in size from one that is barely perceptible to one that fills the anterior chamber and causes glaucoma. These often arise from traumatism, and sometimes include epithelium or a part of an eyelash that has been carried into the iris by some wound penetrating the cornea. They require removal. Benign *granulomata* appear as small, light tumors. *Sarcoma* is occasionally primary in the iris; and *tubercle* occurs in small, white masses that tend to grow. The early removal of the part of the iris containing these latter growths may prevent general infection.

What are the common injuries of the iris; and their treatment?

By bruise of the eyeball the sphincter of the iris may be ruptured, or a portion of the ciliary border of the iris torn from its attachments, making a kind of false pupil back of the margin of the cornea, called *iridodialysis*. The use of a mydriatic and rest are indicated. Blood poured out in the anterior chamber is not likely to cause irritation, and is soon absorbed. Punctured and incised wounds require cleanliness. Foreign bodies lodged in the iris should be removed, along with the part of the iris in which they are embedded.

What is persistent pupillary membrane?

The remains of the membrane that entirely closes the pupil during early fœtal life. Usually there is but one or a few threads, that are attached to the anterior surface of the iris some distance from the pupillary margin, and which float freely in the aqueous humor, without hindering the mobility of the pupil or the transmission of light.

What is coloboma of the iris?

An absence of a part of the iris. The term is sometimes applied to the space left by iridectomy, but is generally, unless otherwise stated, to be understood as a congenital deficiency, usually extending downward from the pupil. If complete, extending to the ciliary margin of the iris, it reveals the border of the lens, and the ciliary processes unless these, too, be partly wanting.

What are the other congenital anomalies of the iris?

eat many eyes the shape of the pupil is not exactly circular, and sometimes the irregularity of shape is considerable. Often the pupil of one eye is slightly larger than the other. Peculiarities in the pigmentation of the iris are often seen, and sometimes the iris of one eye differs in color from the other. This is called *heterochromia*, or *heterophthalmos*. *Corectopia* means that the pupil is not situated in its usual position, but is more or less eccentric. *Polycoria* is the term used to indicate that one or more supernumerary pupils exist, separated from the central pupil and from each other by bridges of iris tissue. *Irideremia*, or *aniridia*, is the condition of complete absence of the iris. In it the whole area of the cornea has the appearance of the pupil. In *albinism* the iris frequently has a pink appearance, due to the shining of the fundus reflex through the stroma, devoid of pigment.

Disorders of the Movements of the Pupil.

What is the normal size of the pupil?

From one to eight millimetres in diameter. Except in extreme cases it is impossible to be certain that the size of the pupil is abnormal, unless we know previously the size of that particular person's normal pupil. In some cases it is difficult to get the pupil to contract below three mm., in others this is the extreme limit of dilatation. These differences of size depend on differences in motility and in the amount of tissue in the iris. The pupil is generally large in children, and small in elderly people.

What is the movement of the pupil associated with convergence?

It contracts when the eyes are converged more strongly, and dilates when the visual axes are allowed to become less convergent or parallel. The absence of any such movement consensual with the accommodation and convergence of the eyes, generally indicates paralysis of the third or oculo-motor nerve, or of the centre for this contraction of the pupil, or posterior synechia. This movement is tested by having the gaze fixed alternately on a distant and a near object, both in a line with the eye, so that the illumination will not be changed.

What is the reaction of the pupil to light?

It contracts as the light entering the eye grows brighter, and dilates as the light becomes more feeble. It reacts most to the light which falls on the most sensitive part of the retina, the macula. The pupil of one eye reacts to the light which falls on the retina of the other eye, as well as to that which falls on its own. The extent of reaction varies greatly in different individuals, but is generally greater in children, and less in old people.

How do you test this reaction?

When in position for the ophthalmoscopic examination in a darkened room, hold the mirror a foot or more from the eye to be tested, and, looking through the aperture at the pupil, alternately throw the light into the eye and then turn it elsewhere, leaving it in comparative darkness. While the eye is in darkness the pupil becomes dilated, and for an instant after the light is thrown upon it remains in this dilated condition, but very quickly thereafter contracts, an appreciable time being required for the reaction. The eye tested should be kept constantly fixed upon one point, usually the aperture in the mirror used. When, in blindness, the pupil still reacts to light, it indicates that the lesion is in the cerebrum; when the reaction is lost, it points to the centres at the base of the brain, the optic tract, nerve or retina, as the seat of disease.

What is the Argyll-Robertson pupil?

The condition in which the pupil does not react to light, although vision shows the eye sensitive to light, and the contraction of the pupil with convergence, proves the motor apparatus concerned to be healthy. It is a symptom very significant of locomotor ataxy, and general paralysis of the insane.

What is the hemianopic reaction of the pupil?

The reaction of the pupil when in a case of hemianopia the light is thrown on the blind half of the retina. It indicates that the lesion causing blindness is back of the corpora quadrigemina. The absence of this reaction, the complete failure of the pupil to contract when light is thrown on the blind half of the retina, indicates that the lesion involves the corpora quadrigemina or the optic tract.

What are mydriasis and myosis, and their significance?

Mydriasis is a persistent dilatation of the pupil, *myosis* its persistent contraction. They occur in so many different conditions as to have no great separate significance. When monolateral, or markedly greater on one side than the other, they point to a focal lesion rather than to the action of a general poison, and hence may be of great importance in cases of coma. But in general the size of the pupil is of much less significance than its reactions under the tests described above.

Diseases of the Ciliary Body and Choroid.

What are the symptoms of inflammation of the ciliary body, or cyclitis?

Pain and tenderness on pressure, and redness of the circumcorneal region similar to those experienced in iritis, but without any inflammation of the cornea or iris to account for them. The pain of simple cyclitis is generally less than that of iritis. Cyclitis rarely occurs except in connection with iritis or choroiditis. It may give rise to disorders of the accommodation, or apparent change of refraction. Purulent cyclitis is a cause of hypopyon. The treatment of cyclitis is much the same as that of iritis.

What are the subjective symptoms of choroiditis?

The pain is of an aching character, and if the inflammation does not involve any other structure is not severe, and often is quite absent. During the acute stage there are subjective flashes of light. There is impairment of vision, though this may be quite insignificant as compared with the changes visible in the choroid, and may not be noticed if it does not involve the region of the fixation point. Spots or clouds are noticed before the eyes. These may be scotomata due to patches of inflammation, in which case they are fixed, or they may be due to opacities in the vitreous, and float about with every movement of the eye.

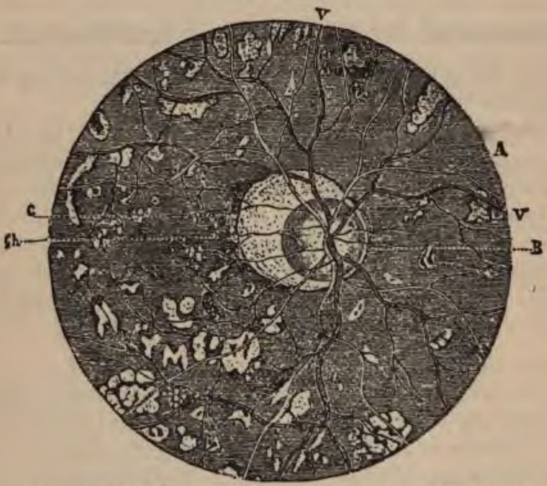
What is the external appearance of the eyeball in choroiditis?

It may be quite normal; but if the inflammation is quite acute, there will be enlargement of the deep vessels that run straight forward in and over the sclera, causing a dull redness of the whole globe, and in very acute cases there is often a good deal of œdema of the ocular conjunctiva.

What is plastic choroiditis?

A series of slow inflammatory changes in the choroid, beginning with hyperæmia and a moderate amount of exudation, and ending usually in a more or less complete atrophy of the part of the choroid involved. It runs a course of months or years, and is apt to begin in one spot and slowly spread to adjoining regions. This definition does not include cases often spoken of as plastic, and in which great quantities of fibrinous exudate are poured out, but accompanied with some formation of pus.

Fig. 42.



Disseminated choroiditis and choroidal atrophy. (*After Noyes.*)

What are the ophthalmoscopic appearances of plastic choroiditis?

At first a blurred appearance due to swelling, which hides the details of the choroid normally visible. This may be a darker red than the normal fundus, from hyperæmia or hemorrhage, or of a light yellowish color, from serous or plastic exudation. Later, changes appear in the pigment layer. It may be simply absorbed, or, as more commonly happens, it is absorbed in some places and at others is heaped up into masses of a brown or black color that form a very striking appearance. At the same time the other tissues of the choroid atrophy, the smaller and often the larger vessels disappear entirely, and over considerable areas nothing is to be seen but the glaring white sclera with which is fused the connective-tissue remains of the choroid. Frequently different parts of the same eye exhibit all the different stages of the process simultaneously. After it has run its course the results of the inflammation continue visible in the fundus throughout life. There are very frequently floating opacities in the vitreous humor.

What is disseminated choroiditis?

Plastic choroiditis, affecting numerous patches of the choroid, separated by portions that are comparatively healthy. This is the most common form, though the number of separate patches involved is often small.

What is central choroiditis?

Plastic choroiditis confined to a single patch in the region of the macula. The retina almost always participates actively in the process and serious impairment of vision, if not complete central scotoma, results. One form of this, occurring in old people, has been called senile choroiditis, another is congenital.

What is sclerotico-choroiditis posterior?

A plastic choroiditis and subsequent atrophy, usually located or beginning at the temporal margin of the optic disk; in which the sclera becomes so far implicated in the process that it softens sufficiently to give way before the outward pressure of the ocular contents, and bulges forming a *posterior staphyloma*. The local process is generally accompanied by general distention of the globe and consequent myopia. The patch of atrophy produced is at first crescentic, and is often called a *myopic crescent*. As it increases in size it becomes more irregular in shape, with a tendency to triangular form, and it is sometimes called a *conus*. This form often appears as part of a disseminated choroiditis.

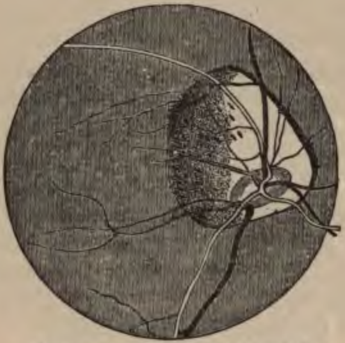
What are the causes of plastic choroiditis?

Constitutional disease or dyscrasia, as syphilis, or the impaired nutrition following the specific fevers; and the habitual congestion of the choroid produced by excessive or improper use of the eyes. The appearances of *syphilitic choroiditis* are not pathognomonic, but it commonly presents numerous small, rounded patches of diseased choroid and round pigment blotches. Posterior staphyloma begins mostly in childhood, disseminated choroiditis is common among elderly people.

How should plastic choroiditis be treated?

The eyes should have rest, at least until all acute swelling and hyperæmia are over. This may embrace the keeping them under the influence of a mydriatic, with the use of dark glasses and careful avoidance of bright lights and sudden changes of illumination; the complete correction of any error of refraction, and when use of the eyes is resumed, care that it shall be under the best conditions of illumination and posture, are matters of great importance. The constitutional condition must also receive appropriate treatment.

FIG. 43.



Posterior staphyloma. (*Liebreich.*)

What is purulent choroiditis?

An inflammation of the choroid attended with the formation of plastic exudate and pus, always acute in its onset, generally attended with redness and œdema outside the sclera, and commonly causing the loss of sight in the eye affected. Usually the whole choroid is involved, and often all other parts of the globe, constituting the case one of panophthalmitis. From the outset the vitreous is so hazy that no view of the fundus can be obtained, and soon even the red reflex is lost. Hypopyon may appear, and not rarely the eyeball bursts and the pus escapes exteriorly. In other cases the eyeball becomes atrophied or shrunken, and every part of it the seat of degenerative change; and the tension of the globe permanently lowered. This condition is known as *phthisis bulbi.* Or without much alteration of the front of the eye the vitreous may remain filled with pus. And in a few cases, resolution and partial restoration of function may occur.

What are the causes and treatment of purulent choroiditis?

Penetrating wounds of the globe, with or without the lodgment of a foreign body, including operative wounds with purulent infection, are the most common cause. But cases result from metastasis, erysipelas, and from other acute febrile diseases, especially cerebro-spinal meningitis. In the majority of cases, all that can be done is to relieve pain by hot applications, employ general antiphlogistic regimen, and as soon as it is evident that the suppuration is becoming general, open the eye freely to give vent to the pus. If, however, the case is mild, an effort may be made to save some vision, or at least the external appearance of the eye. If the eye is believed to contain a foreign body, it is best to enucleate at once.

What is the course of sarcoma of the choroid?

It commences with a tumor visible with the ophthalmoscope, causing an elevation of the retina, but it is not noticed by the patient until it causes opacity of the vitreous or extensive detachment of the retina. After this the intraocular tension increases, the opposite of what occurs in detached retina from other causes, and therefore very significant of an intraocular growth. Later, the sclera or cornea is perforated, and the neighboring tissues involved.

How should sarcoma of the eyeball be treated?

Before perforation of the eyeball has occurred, it should be promptly enucleated; after perforation the whole contents of the orbit should be removed.

What is the appearance of tubercles in the choroid?

That of small, rounded, slightly elevated spots of light yellowish color, surrounded by normal choroid, and located in the posterior portion of the globe.

What is rupture of the choroid?

A deficiency of the choroid, seen as a white crescent concentric with the optic disk, but some distance from it. It is noticed some time after a severe bruise of the eyeball; the injury causing it generally giving rise to so much hemorrhage and vitreous opacity that it cannot at first be seen, but probably its ultimate form is due in part to atrophy of the choroid. If not in the region of the macula vision may not be much affected.

What is coloboma of the choroid?

A patch in which there is a congenital absence of some or all the tissues of the choroid. Usually it is situated below the optic disk, sometimes starting from it, sometimes from farther forward, and extending anteriorly. But it may be only a limited patch in some other part of the fundus.

What is albinism?

A congenital absence of pigment from all parts of the eye, usually accompanying a similar absence of pigment from the skin and hair of all parts of the body. In it the choroidal vessels are all visible, the fundus reflex is unusually bright, and is visible through the structure of the iris, giving it a pink hue.

Sympathetic Ophthalmia.

What is sympathetic irritation?

When one eye has been functionally destroyed and its tissues are the seat of extensive degenerative changes, particularly if the lost globe contain a foreign body, or a calcareous lens or an ossified choroid, it is liable to set up in the other eye, probably through the agency of the ciliary nerves, a neurosis characterized by extreme irritability, pain and hyperæmia, greatly increased by attempts to use the eye. This is called sympathetic irritation. It generally arises a long time after the loss of the first eye, increases gradually and tends to continue indefinitely until the removal of the exciting cause, either by optico-ciliary neurotomy, evisceration, or enucleation of the eye that excites it. After such removal, recovery is prompt and complete.

What is sympathetic inflammation of the eye?

An inflammation which may involve all the tissues of the eye, but in which a plastic or purulent irido-cyclitis and choroiditis predominates, which comes on as the result of previous similar inflammation in the other eye, due generally to a penetrating wound, and especially liable to result from the retention of a foreign body. The eye primarily involved is called the "exciting eye," the other the "sympathizing eye." It is probable that the disease extends directly from one eye to the other along the optic nerves or the neighboring lymph channels.

At what time is sympathetic inflammation likely to occur?

At any time from two or three weeks after the injury of the exciting eye until six or eight weeks after its removal. But few cases occur during the first month, or after the first two years, and it is not likely to occur unless there be at the time, or has recently been, some evidence of inflammation present in the exciting eye.

What are the symptoms of sympathetic ophthalmitis?

The earliest resemble those of sympathetic irritation, which has therefore been regarded as a premonitory stage of the inflammation. There is photophobia, lacrymation, failure of power of accommodation, and discomfort on attempting to use the eye. At this stage the ophthalmoscope may show a distinct inflammation of the optic nerve and retina. The symptoms of iritis supervene, at first serous, then plastic. Then the vitreous becomes cloudy, from choroidal inflammation, vision is greatly impaired, and finally lost in the great majority of cases. The disease runs quite a variable course. Sometimes the sight is lost very quickly. Usually there are partial recoveries and new exacerabations; and sometimes it requires years for the eye to become quiet.

What is the prognosis for sympathetic inflammation?

If the inflammation in the sympathizing eye is really started, probably complete or almost complete loss of sight, although there are a few cases of complete; or almost complete recovery, most of them after early removal of the exciting eye.

What is to be done for sympathetic inflammation of the eye?

Prevent it by enucleation or evisceration of the eye that is liable to excite it. Enucleation is probably a little the more certain preventive, and it is followed by quicker healing and less eye pain. Evisceration leaves rather a better stump, and sometimes a patient will consent to it when he would not to complete removal of the eye.

In what cases should the eye be removed?

1. When it is hopelessly blind and is believed to contain a foreign body, it should always be removed. 2. When it is seriously damaged and is believed to contain a foreign body, and the patient is unable to remain where he can be under frequent observation and at any time resort to surgical aid. 3. When functionally lost by irido-cyclitis, and the patient cannot remain under observation, although no foreign body may be present. 4. When an eye with greatly damaged vision remains persistently inflamed, or is subject to recurring attacks of inflammation. 5. When the sight has been seriously impaired and sympathetic irritation or inflammation begins in the other eye. If the sight of the exciting eye is still useful, and inflammation is begun in the other, the first eye should be retained, as it may in the end be much the better of the two. An eye should not be removed unnecessarily, as even a disfigured stump is less care and inconvenience than an artificial eye.

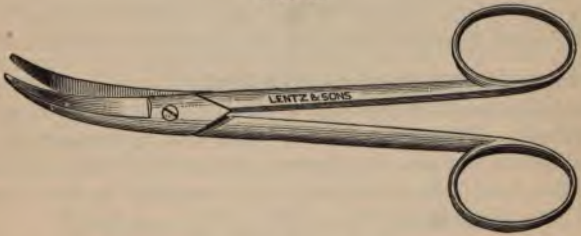
How is the operation of enucleation performed?

If the eye is free from inflammation, it may be done under cocaine with little more pain than an ordinary tenotomy; but if there is hyperæmia of the tissues to be cut, ether should be given to full anæsthesia. Having the eyelids kept apart by an assistant or with a speculum, take in one hand a pair of enucleation scissors (Fig. 44), which should be strong, curved on the flat, and with rounded points, and in the other hand a pair of strong-toothed fixation forceps; fix the eye and divide the ocular conjunctiva all around the cornea; seize firmly the insertion of the internal or external rectus muscle, and drawing upon it divide the tendon just back of where it is held by the forceps. Then pass one blade of the scissors under the tendon of the superior rectus and divide it, with the tissue about it, close to the globe; in the same way divide the inferior, and the other lateral rectus. Then pulling the eyeball well forward, pass the scissors back and divide the optic nerve and adjoining tissue. The globe may now be dislocated forward, and the oblique muscles and any remaining attached tissues separated from it. If the bleeding be excessive, it may be checked by the use of ice, or the orbit may be packed and a compress and firm bandage applied. It is best, however, to wait until all the bleeding ceases; wash out the cavity with mercuric chloride solution, and then apply just enough absorbent cotton to absorb the oozing, making no pressure, but leaving absolutely free drainage. It is possible that tight bandaging is responsible for some of the cases of meningitis that have occurred after enucleation.

What is the operation of evisceration?

By it the cornea and a ring of sclera 1 or 2 mm. wide are removed, and the remaining contents of the globe scooped out, leaving only the clean scleral cup. The interior of the sclera is then to be washed out with a mercuric chloride solution, or cauterized with strong carbolic acid, and the margins of the conjunctiva brought together with a suture. Sometimes a hollow glass sphere is placed within the scleral cup before closing the wound. It furnishes a very perfect stump while retained, but is apt to be extruded after a time.

FIG. 44.



What is the treatment when sympathetic inflammation has actually occurred?

With the exciting eye a piece of the optic nerve should be excised; the sympathizing eye should be put under atropine, and the patient confined to bed in a dark room until the inflammation is fairly subsiding. The eye should be bathed with hot water; quinine and tincture of iron should be given freely, with a moderate mercurial treatment. With recovery the eye must be gradually accustomed to light and use.

Diseases of the Vitreous Humor.

What changes are produced by inflammation in the vitreous?

The bulk of the vitreous is rendered more fluid (*synchysis*), while dust-like, flake-like, linear, or membranous opaque masses are formed that float about and interfere with vision.

What are the appearances of vitreous opacities?

When seen by oblique illumination, as they can be in the anterior portion, they usually have a gray appearance, though blood looks red, or pus yellowish. With the ophthalmoscope they all appear black against the red fundus, which they may hide entirely, except when the vitreous contains crystals, as of *cholesterin*, which reflect the light and appear as brilliant dancing points (*synchysis scintillans*).

How are vitreous opacities to be treated?

Dust-like opacity is generally due to syphilis, and is to be treated accordingly. Others are only to be dealt with by treating the choroidal disease on which they depend; except that dense membranous opacities, fixed behind the pupil, may sometimes be torn through with great advantage.

How does hemorrhage occur in the vitreous?

It comes from choroidal or retinal vessels as a result of injury or vascular disease. In the latter case it may be recurrent. It gives rise to dense opacity at first of a reddish hue, while the vitreous around it is misty. It may be quite absorbed after some time, but generally leaves some floating opacities and disturbance of vision.

When are blood-vessels found in the vitreous?

They exist in it during early fœtal life, and sometimes persist or leave opaque remains, the most common and important is *persistent hyaloid artery*, which comes off from one of the retinal vessels at the optic disk, and runs forward toward the posterior pole of the lens.

Sometimes after repeated hemorrhages into the vitreous a mesh of newly developed blood-vessels, connected with those of the retina, is found extending into it.

What is pseudo-glioma?

A collection of pus in the vitreous, giving rise to a light yellow reflex from back of the lens, resembling in appearance a case of glioma. It occurs after an attack of cerebro-spinal meningitis, or other disease liable to be attended with purulent choroiditis. If the eye be free from irritation, and the diagnosis certain, no immediate treatment may be required. But all the tissues of the eye are liable to undergo degeneration, and it may ultimately require removal for sympathetic irritation.

What is to be done for foreign bodies in the vitreous?

If visible, the effort should be made to extract them by making an incision in the sclera as close to their position as possible, and seizing them with forceps, or, if composed of steel, by drawing them with the electro-magnet. If of iron or steel, the effort should be made to find and withdraw them with the magnet, even when they are not visible. Magnet extraction is only practicable when the body is not bound by inflammatory deposits, and therefore should be practiced as soon after the injury as possible, although in exceptional cases the body may remain a long time free in the vitreous, and capable of extraction.

Diseases of the Crystalline Lens.

What are the normal changes in the lens produced by age?

The lens continues to grow in size so long as it remains clear; it also grows more rigid or consistent, and more refractive, particularly the nucleus. Even in childhood some light is given back from the lens, causing the pupil to have a somewhat gray appearance by oblique illumination; and the amount of light so returned and the consequent grayness of the pupil continue to increase throughout life, so that in old age the normal eye presents an appearance that is very often mistaken for cataract. In the majority of cases the appearance of the pupil is not to be relied on to indicate the presence or absence of cataract.

What is cataract?

Opacity of the crystalline lens or its capsule. Scientifically the term is applied to all kinds of opacities; but the laity understand it to be a progressive disease, or growth, leading to blindness, and in conversation with them the use of the term should be explained, if applied to cases not likely to follow such a course.

What is senile or hard cataract?

The partial or complete opacity of a lens that has so far undergone senile change as to acquire a hard nucleus of some considerable size. It may occur in persons under middle age, but in old people it is probably the rule, rather than the exception, that the lens shows some signs of beginning opacity, though a comparatively small number live long enough for the opacity to increase sufficiently to cause blindness.

What is nuclear cataract?

The form of senile cataract in which the opacity begins by a clouding of the nucleus. This clouding is commonly very diffuse and indefinite in boundary, and tends to progress rather regularly, but very slowly. Its color inclines toward yellow or amber.

What is "second sight"?

A form of myopia that not rarely precedes nuclear cataract, and may be regarded as a sort of premonitory stage. It is due to increased refractive power of the nucleus of the lens, enabling the eye to see near objects with weaker lenses than have been required, perhaps, for many years, or even without any glass at all. But to a corresponding or even greater extent distant vision is rendered more imperfect, with the probability that all vision will later be interfered with, by further changes in the lens.

What is cortical cataract?

Senile cataract beginning in the cortex of the lens. It appears as well-defined masses or radiating lines of opacity, which at first are seen only at the margin of the pupil, or behind the iris, and which are most numerous in the lower part of the lens. These opacities appear rather suddenly, and may remain for a long time stationary. Cortical is the more frequent form for senile cataract to commence in, but both nucleus and cortex are involved before the cataract becomes mature; and often the two forms of opacity are distinguishable in the same lens, while yet a considerable part of the lens is quite transparent.

What is soft cataract?

Opacity of a lens that does not contain any large, firm, nuclear mass. It occurs mostly in young eyes that have not developed a hard nucleus, but is sometimes due to disintegration and liquefaction of the lens substance. Its color is usually whiter than hard cataract, and more uniform. A fluid cataract containing a hard nucleus is called a *Morgagnian cataract*.

What is diabetic cataract?

Opacity of the lens due to diabetes. It occurs in the later stages of that disease, runs a rapid course, and is hard or soft, according to the age of the patient.

What are the different forms of congenital cataract?

Complete, in which the whole lens is opaque. *Lamellar* or *zonular*, in which around a clear nucleus is found a layer of opacity, surrounded again by transparent lens substance. *Posterior polar*, in which there is a sharply limited opacity at the posterior pole of the lens. *Fusiform*, in which there is a spindle-shaped opacity in the axis of the lens; and *central* or *congenital nuclear*, in which the centre of the lens is opaque, with no tendency of the opacity to involve other portions. Occasionally cataract develops during childhood, sometimes allied to congenital, sometimes to senile cataract, but arising at this time, most frequently it is traumatic.

What are the symptoms of cataract?

Dimness of vision. This affects objects in all directions; it may vary considerably with the degree of illumination. Thus, when the principal opacity is nuclear, the vision will be worse with a pupil contracted as it is by a bright light, whereas if the opacity be at the margin of the lens, it will cause the least dimness when the pupil is contracted. Patients often believe their sight varies more from time to time than it really does. Cataract causes absolutely no pain or subjective symptoms other than the dimness of vision.

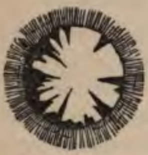
How is cataract to be recognized by inspection or oblique illumination?

The pupil, instead of black, will appear gray, yellowish-gray or white. If of the latter color, or if the pupil presents distinct masses more gray or opaque than the substance surrounding them, this appearance may be sufficient foundation for a diagnosis. But where the gray hue appears uniform throughout the pupil, even though very marked, the lens may be quite normal. It is a common thing for the specialist to have cases referred to him as cataract on the strength of such a gray pupil, when the lens is really quite free from opacity.

What is the best method of determining the presence or absence of lens opacity?

Throw the light into the eye with the ophthalmoscope from a distance of eight to twelve inches, and ascertain if the red reflex that normally occupies the pupil is interrupted by points, lines, or masses of opacity which appear quite black. If the opacity be far advanced no red reflex will be seen, but the whole pupil will have much the same gray appearance it presents on oblique illumination. For this kind of examination no elaborate form of ophthalmoscope is required; any perforated mirror or piece of looking-glass with a hole scratched in the silvering, to look through, will answer the purpose.

FIG. 45.



Senile cortical cataract as seen with the ophthalmoscope.

When cataract is present, how shall its share in causing dimness of vision be determined?

By carefully observing what other causes of impairment of vision exist with it. Considerable opacity in the periphery of the lens may not prevent perfect vision, and when it co-exists with imperfect vision it may be possible by the use of the proper lenses to give normal sight. Or with the cataract there may be some incurable lesion like atrophy of the optic nerve, so that neither the removal of the cataract nor any other treatment will be of any avail. Note, also, if the dimness is about what the existing opacity would be likely to cause. If the opacity is not far advanced, the patient's vision should not be more interfered with than is that of the surgeon when he tries to see the fundus of the eye with the ophthalmoscope. If the fundus is no longer visible, test the power to recognize changes in the brightness of light, quantitative light perception, as by turning a lamp-flame up or down, or passing it nearer to or further from the patient's eye. Also test the power of projection, the power of recognizing the direction of the light when held in different parts of the field of vision. In uncomplicated cataract, light projection and quantitative perception are good. A cataract must be very dense to prevent the counting of fingers held close before the eye.

When is a cataract ripe?

When the layer of lens substance next under the capsule has all become opaque. It will then separate easily and entirely from its capsule, and is in favorable condition for removal.

How do you ascertain if a cataract is ripe?

By throwing a strong light obliquely into the pupil the margin of the pupil is made to throw a shadow upon the opacity; when clear substance still remains between the iris and the opacity this shadow is broad, but if the opacity extends to the surface of the lens the shadow will be very narrow.

What is the natural history of cataract?

It remains stationary for a time, or increases until the whole lens becomes opaque. Then the lens slowly diminishes in bulk, the fluid being absorbed, and the residue tending to become calcareous. Sometimes in children, and very rarely in persons of middle age, it is finally, after some years, absorbed entirely. More frequently the suspensory ligament atrophies, and the lens is dislocated, leaving the pupil clear, but endangering the sight of the eye by the presence in the vitreous of a mass that tends to act as a foreign body.

What can be done to prevent cataract?

The nutrition of the lens is intimately connected with that of the coats of the eyeball; it is probably deranged by any persistent eye-strain or other cause of congestion. Cataract is very frequent in eyes that are myopic with choroidal lesions. So the avoidance of eye-strain is clearly indicated as a preventive. It is probable that senile opacities form or increase most rapidly during periods of impaired general nutrition, so that anything that preserves health may delay the development of cataract. Other alleged preventives and medicinal cures are at best useless.

What can be done for incipient or partial cataract?

Treat complications to which part of the failure of vision may be due, and adjust the glasses that will give the best vision. When the opacity involves the centre of the lens, try if dilatation of the pupil improves vision. If it does, let a weak solution of atropia be used in the eye every two or three days so long as it has the desired effect. If the opacity be at the periphery of the pupil, try if vision can be improved by the use of pilocarpine, which contracts the pupil. It must be used as often as once or twice a day.

When should we attempt to bring about the removal of cataract by absorption?

When the patient is under twenty-five years of age, and there is no reason to suspect an unusually large or hard nucleus; and the opacity of the lens is complete, or so far interferes with vision that the probable improvement to be attained will more than compensate for the inconvenience of wearing strong lenses.

What is discission of the lens; and what treatment is subsequently required?

Cocaine having been instilled, and the pupil previously dilated, a Bowman's stop needle is pushed through the cornea, and made to lacerate the anterior capsule of the lens at the centre of the pupil. It is best to make but a slight laceration at first, and repeat if necessary. This will be followed by the swelling of the neighboring lens substance, and the opacity of any that has remained clear up to this time. Pieces of the lens substance may be pushed out into the anterior chamber, and gradually it is dissolved in the aqueous humor, and the lens shrinks until it is entirely absorbed. During this period the pupil must be kept fully dilated; and if at any time great swelling of the lens, iritis or secondary glaucoma should develop, an incision should be made in the cornea, and the lens extracted at once.

When should a cataract be extracted?

If in a person over the age of twenty-five it is sufficiently advanced to prevent useful vision, and the eye is free from any purulent discharge, and the patient's health fair. The most favorable condition for extraction is that of recent maturity, but when both eyes are so affected that useful vision has been lost, even though neither cataract has reached the stage mentioned, it is best to extract the one that is more advanced.

How is a fluid cataract extracted?

By making an incision through the cornea and a free opening in the lens capsule with the point of the knife, spreading apart the lips of the corneal incision, and making pressure on the eyeball. To get all the lens substance out of the capsule it may be needful to gently press the ciliary region through the closed lids, and then again open the corneal wound and allow it to escape from the anterior chamber. Sometimes the lens substance is removed by suction through a sort of canula, that is introduced through the incision.

What is the operation of simple or flap extraction?

The eye having been cocainized and the conjunctiva washed with a mercuric chloride solution, the lids separated by a stop speculum, and the movements of the eye controlled by forceps, such as are shown in Fig. 19, a cornea knife is entered near one end of the horizontal diameter of the cornea, brought out near the other end of the same diameter, and a semicircular incision in the cornea completed, either upward or downward, according as one or the other incision has been decided on. The capsule of the lens is then freely lacerated with a pricker or cystotome. The margin of the lens nearest the corneal incision is then to be made to present in the pupil by pressing backward on the opposite margin, and when this occurs the pressure is increased and changed in such a way as to push the whole lens through the pupil and into the corneal wound, and this pressure must not be relaxed until the thickest part of the lens has emerged from the corneal wound. The lens is then lifted away and the eye allowed to close and rest. If, for any reason, parts of the cortex remain behind, they must, if possible, be disengaged and extracted by the manipulation described for soft cataract. Different forms of cataract knife are shown in the foregoing figures. The Beer's knife, Fig. 46, makes the smoother incision than the Graefe knife, Fig. 47, which is the more readily managed; while the knife of the writer, Fig. 48, has both these advantages.

What is the modified linear, or Graefe extraction?

The extremities of the incision are made in the extreme corneal margin, and the centre of it somewhat within the upper border of the cornea, after this the iris is drawn out and a portion of it excised. Then the capsule is ruptured, and the lens extracted, much as in simple extraction. The advantages of this operation over simple extraction are that it is easier, and the iridectomy prevents any subsequent prolapse of the iris. But, on the other hand, it causes a permanent noticeable deformity by the iridectomy.

FIG. 46.

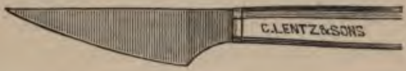
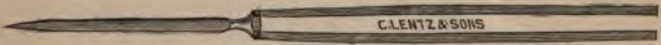


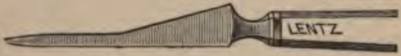
FIG. 47.



What is a scoop extraction?

One in which, on account of the vitreous being fluid, or presenting in the corneal wound, or for other reason, the pressure necessary to force out the lens cannot be applied, a lens scoop or spoon is passed behind the lens and it is lifted out with it.

FIG. 48.



How is the eye to be treated after cataract extraction?

All shreds of tissue having been removed from the corneal wound, and the eye cleansed, and after simple extraction eserine instilled, a little absorbent cotton is to be placed on the lids of both eyes, not enough to make any pressure, but to absorb any discharge; and a bandage of some material like tarletan applied, simply to keep the eyes closed and still, and moderately warm. This bandage is to be removed and the eye cleansed twice daily, until about the fifth day, when it may be omitted and both eyes left uncovered, or the one operated on covered with absorbent cotton, held in place by a strip of plaster, for a few days more. Exposure to very brilliant light or to sudden changes of light should be avoided for some time, until the eye is free from hyperæmia. Subsequently, strong lenses to make up for the loss of the crystalline must be worn.

What is the prognosis for cataract extraction?

Nine out of ten eyes are restored to useful vision.

What is secondary cataract?

The capsule of the lens, with or without any remaining lens substance, or inflammatory exudate, sometimes becomes opaque, and so, or even by its wrinkling alone, interferes with vision. When at all dense, it is called secondary cataract.

What is to be done for secondary cataract?

A free opening must be made in it, either with a needle, or with two needles, introduced through opposite sides of the cornea to the centre of the pupil and then separated by bringing their handles together, or by tearing an opening with one or more hooks, or by cutting out a piece of the offending membrane.

What are the common injuries of the lens?

Puncture or bruise, which cause opacity, sometimes limited to the region injured, more often general. Cases of this sort are to be treated like cases of discission, and may subsequently require that operation or an extraction. *Dislocation of the lens* may be complete or partial. In the latter case it becomes opaque, it causes tremulousness of the iris whenever the eye is moved, because the iris has lost its natural support and is floating freely in the aqueous humor. A completely dislocated lens should be extracted.

What are the congenital anomalies of the lens?

Dislocation, in which the lenses are generally clear and sometimes may be made to present in the pupil, or to drop away from it at will, by a change in the position of the head. Congenital *coloboma* of the lens in which one side of the lens is notched or deficient, often corresponding to coloboma of the iris or choroid. *Aphakia*, absence of the lens as a congenital anomaly, causes high hyperopia, and absence, from childhood, of all power of accommodation.

Glaucoma.

What is the normal tension of the eyeball?

It is the normal outward pressure of its contents. It is necessary to keep the cornea in proper form, the dioptric surfaces the proper distance from the retina, and to enable the extra-ocular muscles to act well on the sclera. It equals usually about 30 millimetres of mercury, but may vary considerably in health.

What is glaucoma?

It is abnormally high tension of the eyeball, with the phenomena intimately associated with such high tension. The increase of tension may be brought about either by increase of the fluid taken from the blood-vessels and poured into the eyeball; or by the checking of its escape from the eye, which takes place mainly at the periphery of the anterior chamber.

What are the subjective symptoms of glaucoma?

Dimness of vision, diminution of the field of vision, and pain in and about the eye. Often there are colored rings or halos around any source of light, but these may not be noticed, and are not peculiar to glaucoma. The failure of vision is usually not uniform. There will be marked, even rapid failure, followed by partial recovery, only to be succeeded by worse failure until all perception of light is lost. The pain is felt in the eyeball, or may be referred to the brow or side of the nose, or the cheek. It presents exacerbations and remissions. It is in some cases absent, especially in the earlier stages of the disease; but it may be the most intense aching or neuralgic pain that is ever suffered.

What symptoms are discovered by external examination of the eye?

The testing of the tension of the eyeball, previously described, shows it to be abnormally high. The cornea is slightly less sensitive to touch than normally, and may be hazy. This haziness when present, is uniform throughout its whole extent, and indicates a recent considerable rise of tension. In the inflammatory form of the disease there is a marked zone of peri-corneal redness, and in old cases the veins which emerge from the sclera near the equator of the eyeball and pass backward, are enlarged and tortuous. The pupil is sluggish, often widely dilated; and the iris appears to be very close to the cornea, making the anterior chamber very shallow.

What are the ophthalmoscopic symptoms?

The media may be so hazy as to prevent any clear view of the fundus, but the most constant symptom of glaucoma, except in very recent cases, is a cupping of the optic disk. The glaucoma cup differs from the physiological cup, in extending the whole width of the disk, and from other excavations of the disk in having abrupt or overhanging sides. And as the retinal vessels pass down the sides of the cup they disappear, so that the part at the bottom of the cup seems disconnected with the part in the retina. This appearance is shown in Fig. 49. Arterial pulsation of the retinal arteries, either spontaneous or producible by slight pressure on the eyeball, is another evidence of high tension; it is noticeable where the artery bends over the edge of the cup.

With what affections is glaucoma likely to be confused?

Inflammation of the cornea when that membrane is hazy and surrounded by a zone of redness. Iritis, in the same conditions. Remember that in iritis the pupil is contracted. Trifacial neuralgia, when there is pain, or sick headache, for the intense pain may cause vomiting or meningitis.

What is the natural tendency of glaucoma when not efficiently treated?

To complete and irremediable blindness, with partial degeneration of the inner coats, and for a period more or less prolonged, a painful globe. Absolute blindness may be reached in a few hours, or only after some years. As a rule, the sight that has already been lost by glaucoma cannot be restored; only the retention of what remains is to be hoped for.

What are the different varieties of glaucoma?

Simple, where the eye is free from inflammatory symptoms. This runs usually a slow course with little pain until the latter part; and it is but slightly amenable to treatment. *Inflammatory*, attended with redness, pain and dilated pupil. It can generally be cured by iridectomy. *G. Fulminans* is the name given when, in the course of one of the other varieties, there is a sudden enormous rise of tension, loss of sight, and other violent symptoms. *Malignant glaucoma* is the term applied to cases in which such an outburst occurs shortly after the performance of an iridectomy.

What is the treatment for glaucoma?

Iridectomy, which must remove one-fifth of the circumference of the iris, well up to the ciliary margin (see Fig. 50), and may be repeated if the first operation does not suffice to permanently reduce the tension. It is commonly done upward, where it will be concealed by the lid. If the patient refuses to submit to iridectomy and the pupil is dilated, eserine solution should be instilled until it causes the pupil to contract, or is proven unable to cause such contraction. In eyes known to have a strong tendency to hemorrhage, or where sight is already lost, *sclerotomy*, may be practiced. It consists of an incision in the corneal margin of the sclera, somewhat like an incision for cataract extraction, but left uncompleted, with a bridge of tissue at the middle of the wound. Tapping of the anterior

FIG. 49.

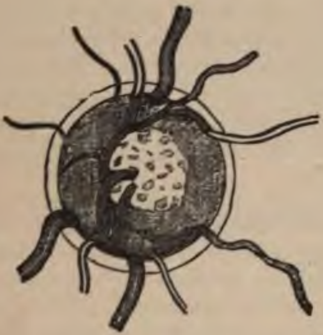
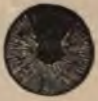


FIG. 50.



chamber, or of the vitreous, may give temporary relief. But other lines of treatment, though they may appear beneficial when a remission is occurring, are not to be trusted.

Diseases of the Retina.

What are the symptoms of retinitis?

Dimness of vision or blindness, usually confined to the portions of the field of vision corresponding to the parts of the retina involved; swelling and opacity of the retina, also localized. The swelling may amount to two or three times the thickness of the normal retina. The opacity varies from a faint bluish-gray to a brilliant white. Retinitis is also very generally attended with hemorrhage. It does not directly give rise to pain, but the inflamed retina is sometimes a source of discomfort. Subjective sensations of light may be noticed.

What is the appearance of hemorrhage into the retina?

That of a dark red mass or area in the level of the retina. If the hemorrhage be in the superficial layer, which is that of the nerve fibres, its shape is largely due to the ease with which it spreads in the direction of these fibres, and its margins have a gradually shading or "feather" edge; such hemorrhages are often described as "flame-shaped." If in the deeper layers, the hemorrhage has a sharper and more rounded boundary. Retinal hemorrhages undergo gradual absorption, leaving a black spot of accumulated pigment or an area of choroidal atrophy.

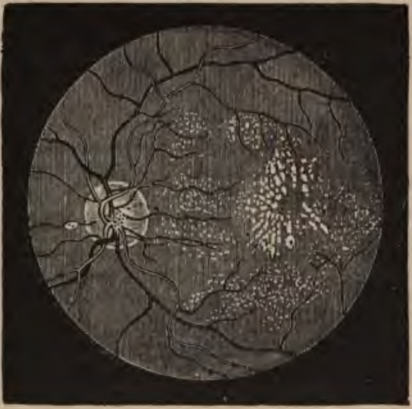
What is albuminuric retinitis?

A form of chronic retinal inflammation or degeneration occurring in connection with chronic Bright's disease, or severe albuminuria of pregnancy. In the latter case it may, on the termination of pregnancy, end in complete recovery and good sight. In connection with chronic kidney disease it is probably always a late symptom, though often the one that leads to the first recognition of the malady. It is intimately associated with the vascular condition of high tension. Little improvement can be hoped for in the retinal condition, and its existence indicates the probability of a fatal termination of the case within a few months or a year or two. Generally both eyes are affected, though in different degrees.

What are the usual appearances of albuminuric retinitis?

The small patches of exudation or degeneration are of a brilliant white. In the region of the macula, where they are apt to appear early and be most numerous, they are more or less arranged in lines radiating from the fovea. Large masses of exudation may have a pale, dirty brown color. There are hemorrhages, often many small ones; and sometimes black specks marking the site of former hemorrhages. The retinal vessels show signs of disease, sometimes aneurismal dilatations, sometimes white opacity of their coats. These appearances are indicated in Fig. 51.

FIG. 51.



Albuminuric retinitis. (*After Jaeger.*)

What is leukæmic retinitis?

A special form of retinitis that attends advanced leukæmia. The exudation is here more general, giving rise to large, diffuse gray opacities. Hemorrhages are numerous and often large; the vessels are all pale, and the arteries small; but the veins appear unusually broad, with a broad light streak upon them. This widening and pallor of the veins may be found in any severe anæmia.

What other important varieties of retinitis are there?

Syphilitic chorio-retinitis, in which the symptoms of retinitis may alone be perceptible in the earlier stages; but as the opacity in the retina disappears, changes are found in the choroid which remain permanent. Exposure to the direct rays of the sun, or to the electric arc-light at too short a distance, causes in the region of the macula a localized retinitis and central scotoma, which may be permanent or may be recovered from, according to the grade of injury. When severe, the retinal lesion may be attended by intense pain and swelling, and injection of the conjunctiva covering the globe and lids.

What is retinitis pigmentosa?

A degenerative affection of the retina, due to congenital or hereditary causes, usually beginning in childhood, and running an extremely chronic course to complete blindness in middle life. It is characterized by night blindness, great concentric contraction of the field of vision, and the deposit of black pigment in the retina, in isolated masses of peculiar shape, something like that of a bone corpuscle; appearing first, and most numerous, in the periphery of the retina. It is not amenable to treatment.

What is the treatment for retinitis?

First, the treatment for any constitutional condition causing it. Complete rest for the eyes, including the avoidance of bright light, and the use of the proper correcting glasses, if any are required. After the acute stage has entirely passed, and there tends to be any permanent scotoma or atrophy, strychnia may be given.

What is embolism of the central artery of the retina?

Sudden dimness of vision, usually passing quickly into absolute blindness, over nearly or quite all of the field of vision; generally permanent, but in a few cases followed by recovery of some part of the field. With the ophthalmoscope, the vessels are diminished, and the veins irregular in calibre. The central part of the retina is all hazy, with œdema, which partially conceals the retinal vessels, except at the fovea, where a small spot retains about its normal color and stands out dark red, in contrast with the surrounding gray retina. Subsequently the fundus returns to its normal color, the vessels contract still further, or become obliterated and replaced by white streaks, and the nerve undergoes atrophy.

What is detachment of the retina?

The separation of the retina from the choroid by a serous fluid, in which it floats with a tremulous movement from every movement of the globe. It is distinguished from other opacities by its uniform membranous appearance and the vessels it contains. It may be caused by a blow on the eye or by shrinking of the vitreous from chronic disease, as is very apt to occur in high myopia. It causes sudden interference with vision, which may vary when the anterior portion is the part detached, by its floating up in front of parts still unaffected. The detached portion generally soon loses its power of vision, but may recover it if it becomes reapplied to the choroid. In general the prognosis is unfavorable, but in some cases sight has been restored by tapping the subretinal space through the sclera, drawing off the fluid, and then keeping the patient in bed for several days or even weeks.

What is glioma of the retina?

A malignant new growth, occurring congenitally or in young children. Starting in the retina, it fills the vitreous chamber with a mass that gives through the pupil a brilliant yellowish-white appearance, with fine blood-vessels upon it. It then pushes forward the lens, causes increased tension of the globe, with external redness, perforates the sclera or cornea, involves the contents of the orbit, and causes death by extension to the brain or by exhaustion. The early removal of the globe with as much of the optic nerve as possible, is sometimes not followed by recurrence, and saves life. Otherwise glioma is fatal.

What is persistent nerve sheath?

The occurrence in the eye of medullary sheaths, to the axis cylinders which alone constitute the normal nerve-fibre layer of the retina. These sheaths are generally lost on entering the globe. When they persist, they cause a brilliant white patch, usually extending *from the edge of* the disk, upward or downward, in the direction taken by the nerve fibres, and having a "feathered" edge. Over this area parts of the retinal vessels will be visible and other parts hidden in the opacity.

Diseases of the Optic Nerve.

What is optic neuritis?

A plastic inflammation of the ocular extremity of the optic nerve. Probably in the great majority of cases the nerve and its lymph channels are affected throughout its whole length; but it is on the ocular end that the violence of the disease expends itself. On this account it is sometimes called *papillitis*. It is also called *choked disk*, on account of the interference with the return of blood through the retinal veins, by pressure from the swelling at this point.

What are the ophthalmoscopic appearances of optic neuritis?

The small vessels of the disk are dilated, so that more of them are visible, and a reddish hue is given to it. This is as pronounced in the mild cases as in the severe, for in the latter the excessive œdema masks the vessels. The retinal arteries are diminished in size, the veins are swollen and tortuous. The outlines of the disk are hidden by the œdematous swelling, and by the extent of this swelling the severity of the inflammation is mainly judged. The height of the swelling is measured by determining the refraction of its most prominent or hyperopic portion, and the refraction of a neighboring unswollen part of the fundus. Generally this swelling, and often the neighboring fundus, presents small hemorrhages.

How is the acuteness of vision in optic neuritis?

Generally it is somewhat impaired, but often so slightly as not to attract the patient's attention, and a very high grade of inflammatory swelling is not incompatible with vision quite up to the standard of normal acuteness. It is, however, liable to be lost as the inflammation passes over into atrophy. After being well retained for a long time it may be lost quite rapidly.

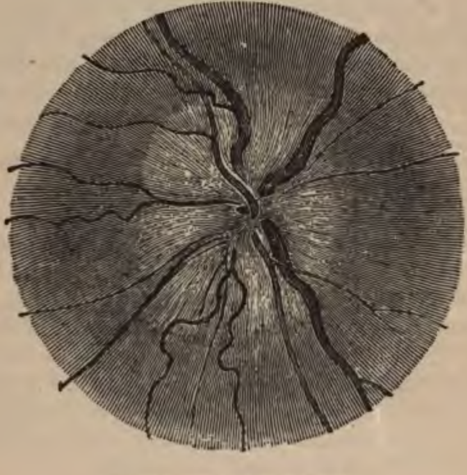
What is the course of optic neuritis?

Usually chronic, lasting months or years, and ending in partial or complete atrophy.

What are the causes of optic neuritis?

Coarse disease of the brain or its membranes, as tumor, encephalitis, meningitis, either tubercular or however produced, hydrocephalus, etc., albuminuria, syphilis and lead poisoning. When due to any of these causes it commonly affects both eyes. A slight neuritis, showing no tendency to atrophy, is not rarely seen as an effect of eye-strain, particularly in school children. As a symptom of obscure brain disease it is often of the utmost importance, distinguishing, as it does, between functional and gross organic disease. Suppression of menstruation, rheumatism, "cold," or local inflammation about the orbit may cause it.

FIG. 52.



Optic neuritis. (*After Meyer.*)

What is the treatment for optic neuritis?

Complete rest of the eyes, and potassium iodide in doses rapidly ascending to the physiological limit; with that of the general condition underlying it, upon the result of which the result of the neuritis must largely depend.

What is retro-bulbar neuritis, or central amblyopia?

It is an inflammation involving a limited portion of the optic nerve behind the globe, and causing interference with the vision at the fixation point and in its neighborhood. Usually there is complete blindness for colors in this region, and decided impairment of vision for form, or black and white. This impairment of vision tends to persist, and become permanent by atrophy. The ophthalmoscopic symptoms are limited to a slight redness and haziness of the disk, in an early stage; and later, paleness of a sector of the disk having its base toward the temple.

What are the causes of this affection?

By far the most common is the prolonged excessive use of tobacco. Hence it is commonly known as *tobacco amblyopia.* The amount of tobacco consumed, that is necessary to cause it, varies greatly; and it partly depends on the condition of the system in other respects. It is very apt to come on when, on account of prolonged worry or strain of some kind, the appetite has been impaired, and perhaps more of the drug consumed than usual. Alcohol, and perhaps some other toxic agents, also cause this affection, either alone or in conjunction with tobacco.

What is the treatment for central or tobacco amblyopia?

Stop all indulgence in tobacco and alcoholic beverages. See that plenty of sleep is secured, and any disorder of digestion rectified. In the early stages give potassium iodide, later, strychnia in doses ascending to the physiological limit, unless complete recovery is previously obtained. In recent cases that fully abstain, the prospect of complete restoration of vision is very good.

What are the ophthalmoscopic appearances of atrophy of the optic nerve?

The disk is pale, of a bluish or grayish cast, or dead white. The small vessels have disappeared from its surface, and the retinal vessels are usually, not always, contracted. The surface of the disk is cupped, the cup extending to the margins of the disk, with sloping, not abrupt, sides. In simple atrophy the details of the lamina cribrosa are unusually distinct. In atrophy from spinal disease, and post-neuritic atrophy they are hidden, and the surface of the disk is of a uniform color. In post-neuritic atrophy the margin of the disk may remain hazy, and sometimes in its neighborhood there are marked choroidal changes.

How is vision affected in optic atrophy?

There is always some limitation of the field, concentric in primary atrophy, irregular in post-neuritic. The fields for colors are first reduced and to the greatest extent. Central vision is usually impaired also, and is often entirely lost. The impairment of vision is not at all closely proportioned to the pallor of the disk, or other ophthalmoscopic symptoms.

What are the causes of optic atrophy?

All that may cause neuritis, pressure on any part of the nerve, various forms of retinitis, embolism of the central artery of the retina, spinal disease, especially locomotor ataxy; and it may arise as an independent affection, though many of the cases that seem to be of this class are but those of its occurrence as a premonitory symptom of sclerosis, which years later may involve the central nervous system.

What is quinine amblyopia?

When a very large quantity of quinine is taken in a short time it occasionally causes blindness, which may at first be complete, but which usually ends in more or less concentric contraction of the field of vision, although central vision may be restored to normal. There are pallor of the optic disk and narrowing of the retinal vessels, which to some extent are also permanent.

What is the treatment for optic atrophy?

The removal or treatment of the conditions causing it, and the administration of strychnia in ascending doses until marked improvement occurs, or the physiological limit is reached. It has been recommended to give the drug hypodermically, but it may be given by the mouth as effectively, and more readily.

Diseases of the Orbit.

What are the symptoms of orbital cellulitis?

Pain in the orbit, increased on pressure, and aching or neuralgic pain referred to adjoining portions of the face. Great swelling of the lids, protrusion of the eyeball, and impairment of some or all of its movements. There may be impairment of visual acuteness, or even complete atrophy of the optic nerve from pressure; or optic neuritis may be set up by extension of the inflammation. Palpation reveals some focus of the inflammation tending to point and discharge externally. The constitutional symptoms of inflammation are usually severe.

What are the causes and treatment of orbital cellulitis?

Injury, including operative wounds, erysipelas, septicæmia, or periostitis involving the walls of the orbit, may give rise to it, or it may be idiopathic. The special failure of its treatment is early, deep, and often multiple, incision, preferably from the conjunctiva, with hot fomentations, to favor external drainage, keep down the destruction of tissue, and prevent intra-cranial extension.

What are the symptoms of orbital periostitis?

If very acute, most of those of cellulitis; but generally there is less swelling and less constitutional disturbance, though the pain may be quite as great. In cases that do not tend to suppuration there may be only pain and tenderness on pressure.

What are the effects of caries of the orbit?

The establishment of a discharging sinus, requiring free opening, the removal of diseased bone, and thorough cleansing and drainage. It is liable by involvement of the parts to cause paralysis of one or more of the ocular muscles, or great deformity of the lids.

What is to be done for injuries of the orbit?

A penetrating wound should be carefully searched for any foreign body it may contain, and thoroughly cleansed. Excessive hemorrhage into the orbit may demand incision, and removal of the blood to prevent atrophy of the optic nerve from pressure.

What is distention of the frontal sinus?

Stoppage of the normal outlet causes accumulation of secretion, until the sinus is filled, then a slow distention with thinning of its wall, which at length undergoes absorption. A tumor presents, usually at the upper inner angle of the orbit, at first hard, but softening as the bone is absorbed. It is to be treated by opening freely, removing its contents, and then reëstablishing the communication between the frontal sinus and the nose.

What tumors affect the orbit?

Cysts, both dermoid and hydatid, require incision and removal. *Carcinoma* and *sarcoma* demand the earliest possible removal, with, if necessary, the removal of the whole contents of the orbit. *Ivory exostoses* of the walls of the orbit are liable to cause pain and destroy the sight of the eye. Unless very broad based, they should be removed.

What is pulsating exophthalmus?

Swelling of the orbital contents with protrusion of the globe, pulsation, and a distinct bruit, were formerly regarded as evidence of true aneurism of the ophthalmic artery. It is now known that they more frequently arise without any change in the vessels, that remains after death. The condition, however, may be due to arteriovenous aneurism, to aneurism within the cranium, or to malignant disease of the brain, or the neighboring bones.

What is exophthalmic goitre; Graves' disease, or Basedow's disease?

A disease of the central nervous system, in which, associated with great disturbance of the action of the heart, and swelling of the thyroid, there is undue protrusion of the eyeball and retraction of the eyelids. The retraction of the lids greatly increases the appearance of exophthalmus, or may alone cause it. The upper lid does not, as in the normal eye, follow the movement of the globe when the eye is turned down. The treatment is mainly that of the general condition. But it may be necessary to protect the eye, to prevent inflammation and perforation of the cornea, from exposure. This may be done by a bandage, or by freshening the edges of the lids at the outer canthus and stitching them together, and so narrowing the palpebral fissure. Or it may be worth while to resort to the latter proceeding for cosmetic purposes.

Drugs and Formulæ.

What are the antiseptics to be used in the eye?

Boric acid is often spoken of as an antiseptic, but it is certainly of very little value in this direction. Strong *alcohol* and *boiling water* are the best agents for the disinfection of smooth, polished instruments; and boiling water or mercuric chloride solution for other instruments. For disinfection of diseased surfaces the mercuric solutions are the most reliable and satisfactory.

Mercuric chloride,	1
Distilled water,	1000

This is to be used for disinfecting instruments, purulent corneal ulcers, the lacrymal passages in dacryo-cystitis, or the conjunctiva in purulent conjunctivitis. It is also to be used to cleanse the eye after operations.

Mercuric chloride,	1
Distilled water,	5000

may be prescribed for the patient to use as an eye lotion in acute or chronic conjunctivitis, attended with considerable discharge. It may be used from once a day to every hour, and causes usually but little irritation.

A solution of the strength of 1 to 3000 is better for cleansing the eye and lids prior to operating, after an operation, or at subsequent dressings, and as a collyrium when the discharge of pus is profuse.

Mercuric iodide,	1
Potassium iodide,	5
Distilled water,	20,000

essentially the solution introduced by Panas, and known by his name, may be used instead of the bichloride solutions, or to wash out the anterior chamber in hypopyon or after cataract extraction. But for the latter purpose distilled water may be better.

Although not used with the idea that it is antiseptic, it is convenient to mention here the ointment of the *yellow oxide of mercury*, employed as an application to the lids in marginal blepharitis, chronic conjunctivitis, phlyctenular disease and corneal opacities. Its proportions are :—

Precipitated mercuric oxide (yellow oxide of mercury),	1
Vaseline, or similar petroleum preparation,	60

It should be applied daily, placing a mass the size of a grain of rice on the inner surface of the lower lid, closing the lids and gently rubbing them for a minute or two to diffuse it throughout the conjunctival sac. Ointments of three or more times this strength may be found beneficial, but in some cases cause severe irritation, so that it is best to try first the strength mentioned.

What astringents are used in the eye?

Silver nitrate, though classed here, is also a valuable antiseptic.

Silver nitrate,	1
Distilled water,	100

This is to be applied to the inner surface of the lids in acute conjunctivitis once daily, the freedom with which it is applied to be graduated to the amount of muco-purulent discharge. A solution of double the above strength may be used when there is a large amount of purulent discharge, or to drop into the eyes of the newborn infant when there is reason to fear ophthalmia neonatorum; and still stronger solutions may be employed in purulent conjunctivitis. Care must be taken that these solutions, when kept, do not lose strength by precipitation of the silver, or become concentrated by evaporation of the water.

Copper sulphate is employed in the form of the pure crystal ground and shaped into a smooth pencil, for application to granular lids, and as a caustic to the interior of chalazia, etc. The crystal should be dry when applied, and a light application can be made by passing quickly over the part, a more severe one by leaving it longer in contact with the tissue.

Tannin is used in the officinal glycerole or in the following form, half the officinal strength :—

Tannin,	1
Glycerine,	8

This is applied freely to the everted lids, once daily or at longer intervals, for different forms of chronic conjunctivitis. Probably the glycerine should be credited with a considerable share of the beneficial influence.

Zinc sulphate is used in solution, dropped in the eye one to three times a day, for chronic conjunctivitis.

Zinc sulphate,	1
Distilled water,	400

This can be prescribed for the patient to use at home, when he is unable to come for applications of the stronger astringents by the surgeon. The strength may be doubled, or diminished by half. It is a comparatively painful application.

Alum may be used in crystal like sulphate of copper, than which it is much milder, or a solution—

Alum,	1
Distilled water,	30

which may be dropped in the eye three times daily or oftener.

How is cocaine to be used in the eye?

A solution of—

Cocaine hydrochlorate,	1
Distilled water,	25

is most generally useful. To secure anæsthesia for the removal of a foreign body, or an operation involving incision of the cornea, one or two drops are to be placed on the part to be operated on, and the application repeated in a couple of minutes. Two minutes later the part is in the best condition for operation. If the operation is a tenotomy for strabismus, or the foreign body in the cornea has given rise to inflammation, it is worth while to repeat the application two or three times more, at similar intervals. When the operation involves the iris a drop may be placed in the anterior chamber after the completion of the corneal incision, but especial care must be taken to have the solution so used absolutely free from foreign matter. For operations on the inner surface of the lids stronger solutions, even up to saturation, are to be used. When the operation is to be done on the skin of the lids, the surface should be soaked with the solution for a half-hour prior to the operation. When cocaine is used to dilate the pupil, a half-hour or more must elapse before its full effect will be produced.

What are the mydriatics, and how are they used?

Atropin may be used in the following solution:—

Atropin sulphate,	1
Distilled water,	60

One drop of which is to be placed on the cornea every ten minutes, to secure dilatation of the pupil in iritis; these applications to be continued until dilatation occurs, or the continuance of them for a half-hour or more shows it is not possible, and after dilatation is obtained they may be made every two or three hours to sustain it.

To paralyze the accommodation, as for the measurement of ametropia, and to secure a prolonged rest for the ametropic eye, or in corneal ulcer threatening central perforation—

Atropin sulphate,	1
Distilled water,	120

is to be instilled, one drop at a time, three times a day. Two weeks are required for the eye to completely recover from the effects of such a solution.

To dilate the pupil in partial cataract,—

Atropin sulphate,	1
Distilled water,	5000

one drop to be instilled every day or to.

Daturin, *duboisin* and *hyoscyamin* are to be used alike, being practically identical. In general their solutions require to be about half the strength of those of atropin. To produce paralysis of the accommodation,—

Hyoscyamin hydrobromate,	1
Distilled water,	240

may be instilled, one drop, three times daily. It requires about one week for the eye to recover from such a solution.

Homatropin, on account of its brief period of influence, is the best mydriatic for purposes of diagnosis. It is used in—

Homatropin hydrobromate,	1
Distilled water,	40

one drop of this to be placed on the upper part of the cornea every ten minutes for a half-hour or more, and the refraction determined a half-hour later. After this, recovery is complete in two days. A solution one-tenth the strength of the above is sufficient for dilatation of the pupil.

What are the myotics, and how are they used?

Eserine is employed, as in—

Eserine sulphate,	1
Distilled water,	400

one drop instilled into the conjunctival sac, to prevent prolapse of the iris after simple extraction of cataract, or to contract the pupil in acute glaucoma or perforation of the periphery of the cornea. In simple corneal ulcer, mydriasis, etc., solutions from one-half to one-tenth the above strength are employed.

Pilocarpine is a considerably weaker myotic than the foregoing. It is used as,—

Pilocarpine nitrate,	1
Distilled water,	200

two or three drops in the eye at bedtime, for asthenopia not dependent on ametropia or muscular derangement; or twice a day, to contract the pupil, in cortical cataract.

What drugs are used for their soothing influence on the conjunctiva?

Boric acid and *borax* are both soothing and cleansing. They may be used as—

Boric acid,	3
Sodium biborate,	1
Distilled water,	100

five or ten drops of which may be instilled three times a day or oftener. Or the same proportion of either of the drugs alone may be used in the same way.

As a soothing application, or as a placebo, the following is good:—

Sodium chloride,	1
Distilled water and Camphor water, each	100

It is to be used as the boric solutions.

PART II.

ESSENTIALS
OF
DIAGNOSIS AND TREATMENT
OF
DISEASES OF THE NOSE AND THROAT.

GLEASON.

ESSENTIALS OF DIAGNOSIS AND TREATMENT
OF
DISEASES OF THE NOSE AND THROAT.

The Laryngoscope.

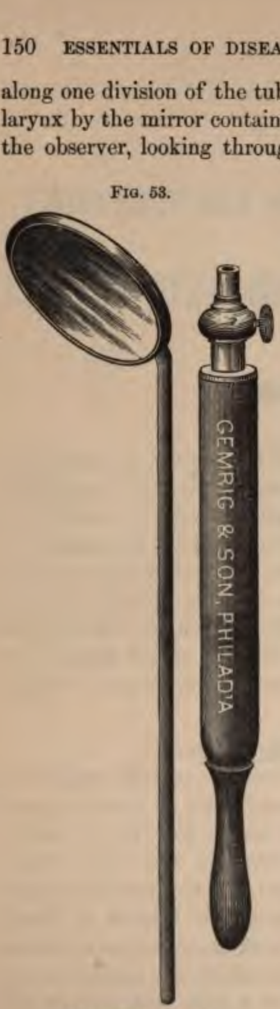
What is the laryngoscope?

The laryngoscope is a combination of two mirrors so arranged as to enable the observer to see the interior of the larynx. In the more common form the larger and concave mirror, called the reflector, is attached to the observer's head by a head band, and the smaller and plane mirror, called the laryngeal mirror, is introduced into the back part of the mouth in such a manner as to be directly above the opening of the glottis; so that light reflected from the reflector upon the laryngeal mirror illuminates the interior of the larynx, and enables the observer to see its image upon the surface of the small mirror.

Give briefly the history of the laryngoscope.

Recent excavations at Pompeii have brought to light small metal mirrors with slender handles, that are supposed to have been used to inspect the accessible cavities of the body. In 1743, M. Levret, a distinguished French accoucheur, invented and used a small mirror for seeing small polypoid growths inside the nose, throat, ear, etc., and facilitating operations upon them. Dr. Bozzini, of Frankfort-on-the-Main, in 1807, published a work describing an apparatus he had invented for illuminating and examining the cavities of the body. His "laryngoscope" consisted of a tube, bent near its end at a right angle, and divided longitudinally by a septum into two portions. In each portion of the tube at its angle a mirror was set, so arranged that, when the tube was inserted into the mouth and its bent end directed toward the opening of the larynx, light passing along one division of the tube would be reflected downward into the larynx by the mirror contained in the instrument; while the eye of the observer, looking through the other portion of the tube, would perceive the image of the glottis reflected in the mirror which this portion of the tube contained. In 1825 Cagniard de Latour, and in 1827 Senn, of Geneva, each made unsuccessful attempts to examine the living larynx by means of mirrors. In 1829 Benjamin Guy Babington used a small mirror placed in the back of the mouth, while an ordinary hand-glass was used to reflect sunlight upon it. While Babington was perfecting his instrument, a mechanic, named Selligue, constructed an instrument similar to that of Bozzini, by means of which his physician, Bennati, said he was enabled to see the vocal cords. However, he brought about a cure of the throat affection from which Selligue suffered. A number of others worked in the same field, among whom may be mentioned Baumes, of Lyons (1838); Liston, using a dentist's mirror for laryngoscopy, in 1840; and Warden, of Edinburgh, a prism of flint glass, attached to a long stem, for the same purpose; whilst Avery, of London, employed a speculum, with a mirror in its end, for examining the larynx, which was illuminated from a concave reflector worn upon his head. In 1854, Signor Manuel Garcia, by means of a dentist's mirror and a hand-glass, was, for the first time, enabled to *study* the movements of his own vocal cords during phonation, and accurately described the registers of the voice in a paper read

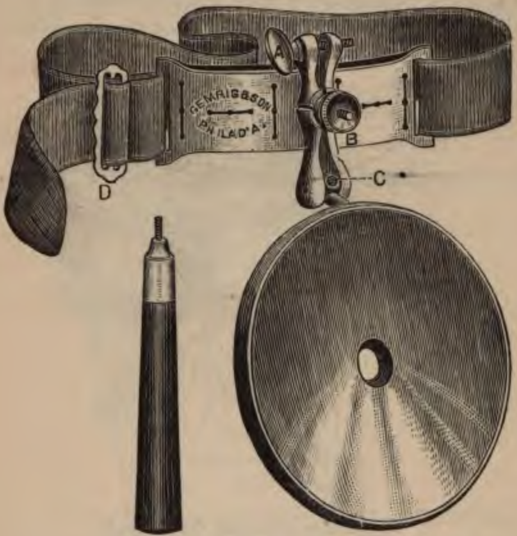
FIG. 53.



Laryngeal mirror.

before the Royal Society of London, in 1855. In 1857, Türck, of Vienna, began to use the laryngeal mirror on his patients, and he and Czermak, who substituted artificial light for sunlight, improved their apparatus until the laryngoscope was perfected to the form that is used at the present day.

FIG. 54.



The reflector.

Describe the laryngeal mirror.

The laryngeal mirror consists of an oval or round piece of silvered glass, mounted in a metal frame and attached to a wire stem at an angle of not less than 120°. Such mirrors vary in size from one-half an inch to an inch and a half in diameter, and are numbered 1, 2, 3, 4, 5, by instrument makers. The wire stem is either fixed in a handle of wood or slides into a hollow handle of hard rubber, and is clamped at any desired length by a set screw. (Fig. 53.)

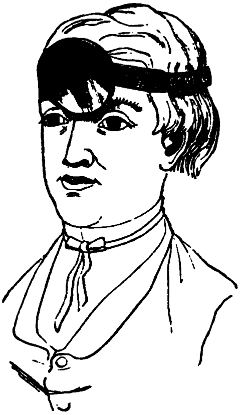
Describe the reflector of the laryngoscope.

The reflector is a concave mirror, of about three and a half inches diameter; about twelve inches focus; and made of silvered glass, mounted in a metal frame, so arranged that it is capable of attachment by a universal joint either to a head band or the source of illumination. (Fig. 54.)

How should the reflector be worn?

The reflector should be worn upon the forehead over the left eye, and the light should be reflected from it upon the face of the patient, so as to form a circle, bounded above by the tip of the nose and below by the front of the chin. (Fig. 55.)

FIG. 55.

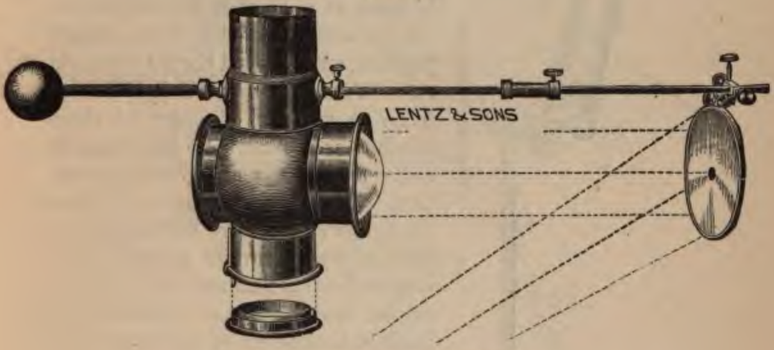


The reflector worn upon the forehead.

What sources of light are used in laryngoscopy?

An ordinary coal-oil lamp, or even a candle, the electric light or a gas jet, may be employed. Direct sunlight through a hole in the shutter may be used, and a plane mirror, instead of a concave one, should then be worn upon the forehead. Tobold, Mackenzie, and others have invented light concentrators, where convex lenses are used to concentrate the light upon the reflector. Such an apparatus, containing one or more lenses, and made to fit over a student's lamp or Argand burner, can be obtained in the instrument stores. The instrument shown in Fig. 56 is perhaps the best of these, and may be used either over an ordinary student's lamp, Argand burner, or, as modified by Dr. Vedder, the electric light can be placed within the apparatus. A reflector, also, as shown in the cut, can be attached to the instrument in such a manner that it will reflect light into the nose or mouth, and thus do away with the necessity of wearing it upon the forehead. A tube of ordinary sheet iron, without lenses, but with an opening in its side, when fitted over the chimney of an Argand burner or student's lamp in such a manner that the opening is opposite the flame, answers a very good purpose. Such an apparatus gives enough light for all ordinary examinations with the laryngoscope, and has the advantage that it may be used for the opththalmoscope as well.

FIG. 56.



Light concentrator, with reflector.

What is the most advantageous position for the source of light in laryngoscopy?

The source of light should be at the patient's left, somewhat behind him, and on a level with the top of his ear. As the heights of patients vary greatly when seated, it is well to have some means

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What optical law is involved in laryngoscopy?

The optical law involved in laryngoscopy is that *the angle of reflection is equal to the angle of incidence.*

How is this law practically illustrated in laryngoscopy?

This law is illustrated by the fact that the laryngeal mirror must be placed in the back part of the patient's mouth, above and behind the larynx, and at such an angle that light received on its surface is reflected downward into the larynx. The rays then forming the laryngeal image will return along the same path, and be reflected at the same angle into the eye of the observer. From this it follows that the nearer the centre of the head mirror is placed to the eye of the observer, the better will the image of the larynx be seen. (Fig. 58.).

FIG. 58.

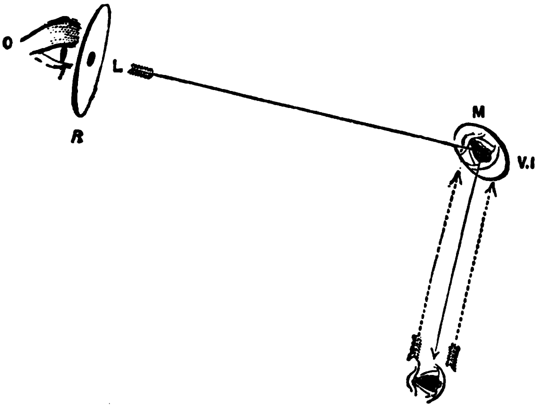


Diagram illustrating the principle of the laryngoscope. (*Brown.*)

In looking at the image of the larynx, what should we bear in mind?

We should bear in mind that the image is a reflected one, and that, therefore, it is reversed antero-posteriorly, owing to the fact that the laryngeal mirror is above and behind the opening of the larynx. (Fig. 59.

Describe the relative position of the patient and observer in laryngoscopy.

The observer should sit opposite to the patient, so that his eye is on the level with, and about a foot from, the mouth of the patient, whose head should be slightly raised and inclined backward. The knees of the observer should be either at the left or on either side of the patient's knees. For office use it is most convenient to have piano stools, which can be raised or lowered, so that the difference in the heights of different patients can be compensated for, and the eye of the observer can be brought on a level with that of the patient; while the patient's head may rest upon a cushioned framework fastened to the wall. If a head reflector be used, it is advisable to obtain an easy position for the head, and *then* move the reflector until the disk of reflected light falls in the opened mouth of the patient with its centre at the base of the uvula, thus illuminating all the surrounding parts.

FIG. 59.

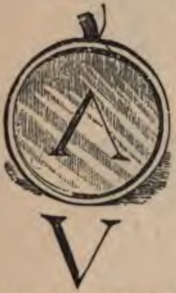


Diagram of laryngeal mirror, illustrating the reversion of the reflected image. (*Brown.*)

How is the laryngeal mirror introduced?

The laryngeal mirror is first warmed, but not heated, by holding it for a short time, with its reflecting surface downward, over a flame, to prevent moisture condensing upon it. The handle should be held between the thumb and forefinger of the right hand like a penholder, with the reflecting surface of the mirror downward. The arm should be flexed upon the arm and the hand slightly backward upon the wrist and a little below the mouth of the patient. By a forward motion of the hand and a slight raising of the arm, and unbending of the elbow, the mirror should be quickly carried into the mouth, following the curve of the hard palate until the back of the mirror touches and raises the uvula, pressing it upward and backward as far as possible. Meanwhile the left hand of the observer has grasped the patient's protruding tongue, holding it well forward by means of a towel or napkin to prevent slipping through the fingers.

How should the tongue be held by the observer?

The protruded tongue of the patient should be grasped between the outstretched thumb and index finger of the left hand, protected by a napkin or towel to prevent slipping, in such a manner that the forefinger being placed against the lower teeth, projects above their edge, and thus forms a roller upon which the tongue can move without its frænum coming in contact with the sharp edge of the lower incisors. The thumb being placed on the upper surface of the tongue, and the middle finger under the chin of the patient, a slight rotatory motion of the observer's left hand will then not only control the motion of the tongue of the patient, but also keep all involuntary movements of his head in check, as the bit in a horse's mouth controls the animal's action. When the operator has to use both hands in operating or making applications, the patient should be taught this manœuvre and requested to hold his tongue forward himself.

What precautions should be observed in introducing the mirror?

The mirror should not touch the tongue or palate; and, when in position, it should be held steadily and not allowed to tremble, or gagging as well as retching will result. Should the slightest sign of this occur, the mirror must be quickly withdrawn, and only reintroduced when the patient has had time to recover his breath and confidence; or the gagging will be repeated on an attempt to reintroduce the mirror, and the throat finally become so sensitive that a further examination will be impossible at that sitting.

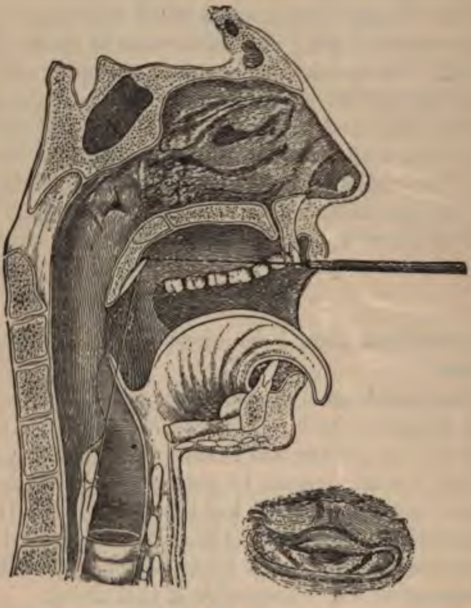
When the laryngeal mirror is in position at the back part of the mouth, how is the laryngeal image brought into view?

The handle of the mirror is brought to one side until it lays in the angle of the patient's mouth, and the hand holding it is steadied by one or two fingers resting on the cheek of the patient. This procedure brings the hand out of the line of vision. The mirror is next slowly but steadily turned until the image of the larynx appears upon its surface. The patient should now be requested to say "Ah," in order to cause a rising of the epiglottis and bring the image into view.

How should the temperature of the mirror be tested?

The temperature should always be tested by laying the back of the mirror against the skin of the hand, and never against the cheek; because a slight abrasion of the skin of the cheek easily escapes notice, and may be inoculated with specific poison by the back of the mirror, which has previously come in contact with the *secretions* of a patient suffering from specific disease.

FIG. 60.

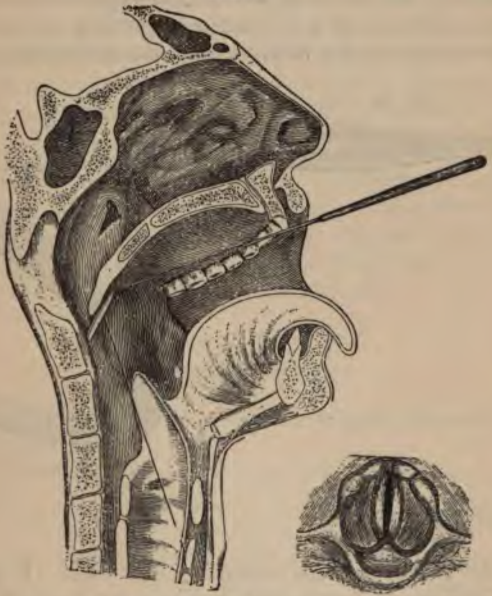


Sectional view, showing the position of the head of the patient which will give the minimum amount of view. The laryngeal image in such a case is represented in the smaller figure at the side. (*Brown.*)

What are the obstacles to laryngoscopy?

1. Irritability of the pharynx, produced by trembling of the hand holding the mirror, causing gagging and retching. 2. Want of proper adjustment of the light, without which the larynx cannot be illuminated, even when the mirror is in the proper position. 3. Undue irritability or peculiar formation of certain parts of the throat.

FIG. 61.



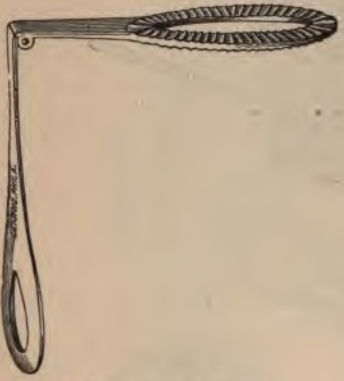
Sectional view, showing the position of the patient's head and the laryngeal mirror that will give a full amount of view of the larynx. The laryngeal image in such a case is represented in the smaller figure at the side. (*Brown.*)

4. Raising of the back of the tongue upon the approach of the mirror, in spite of the traction made upon its tip. 5. Too large or pendent epiglottis.

How should these obstacles be overcome?

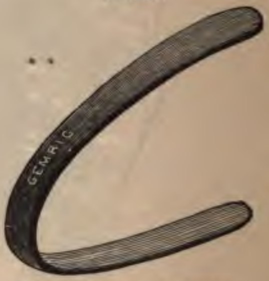
Gagging and retching can generally be prevented by avoiding to touch the tongue and palate while introducing the mirror, and by holding it steadily in its proper position when introduced. Irritability of the pharynx may be relieved by letting the patient swallow a glass of ice water before introducing the mirror; or, if that should fail, the use of a spray of cocaine solution from an atomizer will generally produce the desired effect. If the back part of the tongue rises so as to obstruct the view, in spite of traction on its tip, it may be caused to lie flat in the mouth by steady pressure with a tongue depressor. (Figs. 62, 63.) When the epiglottis is too large or pendent, so as to obstruct the view, we can sometimes see the glottis by causing the patient to laugh or sing in a high pitch. If this fails, a pair of bull-nosed artery forceps, having a small weight attached to it with a thread, may be fastened to the margin of the epiglottis; thus keeping it elevated during the examination or operation by the small weight, which hangs out of the mouth.

FIG. 62.



Folding tongue depressor.

FIG. 63.



Cohen's tongue depressor.

How is auto-laryngoscopy accomplished?

The observer who wishes to study his own larynx should seat himself with his back toward a window through which the direct light of the sun enters. In front of him should be a plane mirror, so placed as to reflect a ray of sunlight into his open mouth. All being in readiness, he seizes his tongue with a napkin held in his left hand, and pulls it forward. His right hand now carries a laryngeal mirror to the back of the mouth, its progress being watched in the mirror before him. When properly placed, the sunlight from the plane mirror is reflected by the laryngeal mirror into the larynx, and its image appears upon the laryngeal mirror and is reflected forward upon the plane mirror, where it may be studied by the observer. Artificial light may also be used for auto-laryngoscopy, by having the source of illumination at one side of, and on a level with, and slightly behind the observer's head; while a concave reflector is placed at one side of the plane mirror to reflect the light upon the laryngeal mirror in the back part of the mouth.

How is infra-glottic laryngoscopy accomplished?

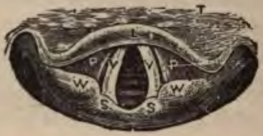
In some cases in which tracheotomy has been performed and the canula is fenestrated, a small mirror may be so introduced into the canula as to obtain a view of the under surface of the vocal cords, which are red instead of white. Unfortunately, the mirror must be so small that little else can usually be seen.

Laryngeal Image.

Describe the appearance of a normal larynx as seen in the laryngeal mirror.

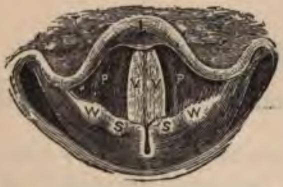
At the upper part of the mirror is seen the reddish-yellow arch of the epiglottis (L) with its cushion (C). In front of the epiglottis and extending downward across the mirror are seen two pairs of bands: the outer red, and the inner of a pearly white. The former are the ventricular bands (P), while the latter are the vocal cords (V). In deep breathing, a triangular opening is seen between the vocal cords, through which we can see into the inferior cavity of the larynx, and view the anterior part of the cricoid cartilage as well as some of the tracheal rings below it (W, P). In some cases two dark circles can be seen in the depth of the trachea, indicating the openings of the bronchi (B). During tone production the opening between the vocal cords is narrowed to a slit, and this space is called the *rima glottidis* or *glottis* (chink of the glottis). At the termination of the vocal cords we see the arytenoid cartilages, with the inter-arytenoid space or commissure between them. From each side of this commissure, a fold, called the *ary-epiglottic fold*, extends forward to join the arch of the epiglottis. Upon each of these folds we see two nodules: the cartilages of Wrisberg (W), and the cartilages of Santorini (S). These latter surmount the arytenoid cartilages. Attaching the epiglottis to the tongue is seen in the mirror a light-colored band: the glosso-epiglottic fold. On each side are two grooves, called the glosso-epiglottic fossæ. The color of the mucous membrane, as seen in the laryngeal image, varies from the pearly whiteness of the vocal cords to the reddish-yellow of the epiglottis, and the pink-red seen in other localities. There is also considerable variations of color, within the limits of health, in different individuals, and even in the same individual under different conditions. As seen by artificial light, it is always redder in color than when seen by means of direct sunlight.

FIG. 64.



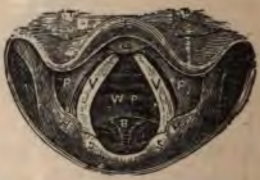
The larynx in gentle breathing.

FIG. 65.



The larynx in tone production.

FIG. 66.



The larynx in deep breathing.

Rhinoscopy.

What is rhinology?

Rhinology is the art of seeing, and knowing what you see in the nose.

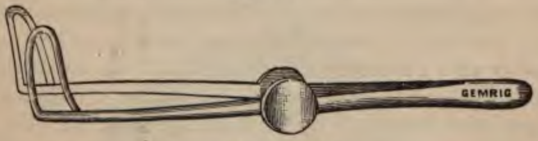
What is rhinoscopy?

Rhinoscopy is the art of inspecting the nasal cavities, and may be divided into anterior and posterior rhinoscopy. Anterior rhinoscopy is the inspection of the anterior nares through the nostrils, and posterior rhinoscopy is the inspection of the vault of the pharynx and of the posterior nares from behind.

What are the anterior and posterior nares?

These terms should be applied solely to the anterior and posterior openings of the anterior nasal cavities.

FIG. 67.



Bosworth's nasal dilator.

What is the posterior nasal chamber, or post-nasal space?

The post-nasal space, as it is at present most commonly called, is the cavity bounded in front by the posterior nares, above by the vault of the pharynx, behind by the pharyngeal wall, and below by the soft palate.

How is anterior rhinoscopy accomplished?

The simplest method is to raise the tip of the nose with a finger, and draw the ala away from the septum by means of a bent probe. If now the patient's head is tilted somewhat backward, and a strong light is made to enter the dilated nostril, the nasal cavity will be illuminated for a considerable distance, and the condition of its lining mucous membrane may be inspected. The opening of the nostril may, however, be effected more conveniently by means of an instrument called a nasal dilator, of which there are an endless variety for sale in the market. Of these, perhaps the most useful is the nasal dilator of Bosworth. (Fig. 67.) A great many of the "Bosworth dilators" for sale in the instrument stores are nearly useless, on account of the manner in which they are constructed. The best which I have seen were made of German silver or brass nickel plated, so that the shanks of the instrument can be bent, in order to modify the amount of separation of its blades. The blades which enter the nose should be perfectly flat, without any outward flare to their tips, and so constructed that they are always perfectly parallel when separated or brought together. The blades should be set upon the shanks at an angle of 110°. When made in this shape, the instrument is nearly self-retaining, and can be more quickly introduced into the nostrils than the author's dilator. Unfortunately, however, it is retained with so little firmness in the nose, that it is frequently displaced during the course of a long operation and may fall upon the floor, greatly to the annoyance of the operator. The author's nasal dilator overcomes this difficulty by being entirely self-retaining, and may be attached to a head-band upon the patient's forehead in such a manner as to draw upward the tip of the nose sufficiently to secure the best possible illumination of its interior, and at the same time leave both hands of the operator free. (Fig. 68.) * All nasal dilators, however, tend to expose the parts in a distorted condition, and thus deceive the observer as to the amount of breathing space that exists in the anterior nares. Harrison Allen's hard

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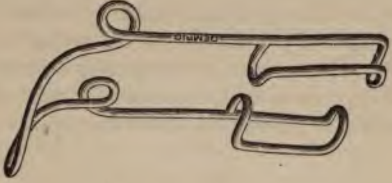
* The idea of devising this instrument was given me by a physician visiting the office of Dr. Carl Seiler, whose assistant I was at that time. This gentleman, a stranger in the city and whose name I have unfortunately forgotten, showed me an ordinary eye speculum that he had bent in such a manner as to make it answer admirably as a nasal dilator. We went together to Mr. Yarnall, the instrument maker, who was shown the device. After considerable experimenting, with Mr. Yarnall's help, the instrument assumed the form I am now using. In most noses it is perfectly self-retaining and cannot be shaken out by the struggles of a patient during an operation. Dr. Carl Seiler has modified the blades of the instrument in such a manner as to have a longer blade toward the septum, thus necessitating making the instrument in pairs, one for the right nostril and one for the left. I do not think the idea a good one, as the instrument thus modified gives no better exposure of the interior of the nose.

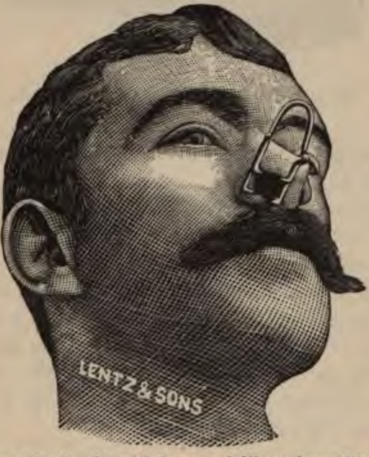
rubber nasal specula, as they do not dilate the nostrils so widely, enable the observer to judge of the amount of obstruction to nasal respiration produced by a deviated septum or anterior hypertrophy much more accurately than he could do with a dilator; and a nest of these instruments should always be at hand to be used in such

FIG. 68.



The author's nasal dilator.

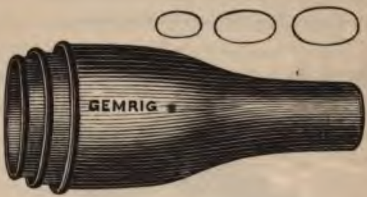
FIG. 69.



The author's self-retaining nasal dilator in position.

examinations. (Fig. 70.) When using either dilator or speculum, the instrument and patient's head should be moved in such a way that the different parts of the interior of the nose are successively brought in view. Any secretions that obstruct the view should be removed by means of the atomizer or forceps, or wiped away with cotton wrapped on the end of an applicator; and any change in the bulk of the parts should be tested with the probe, in order to determine its density. If an anterior hypertrophy obstructs the view of deeper structures, cocaine solution should be applied to reduce its size and allow light to penetrate into the deeper parts of the interior of the nose.

FIG. 70.



Harrison Allen's hard rubber nasal specula.

Describe the appearance of the interior of the nose as seen in anterior rhinoscopy.

The first structure brought into view is the vestibule, in which are seen a number of coarse hairs called vibrissæ, while a fold of skin or mucous membrane lies between the vestibule and the inferior meatus. To the inner side is the septum and to the outer side the inferior turbinated bone, forming the roof of the inferior meatus. Above the inferior turbinated bone is the middle meatus, roofed in above except for the olfactory slit, by the middle turbinated bone. Through the olfactory slit in some individuals a portion of the superior turbinated bone may be seen.

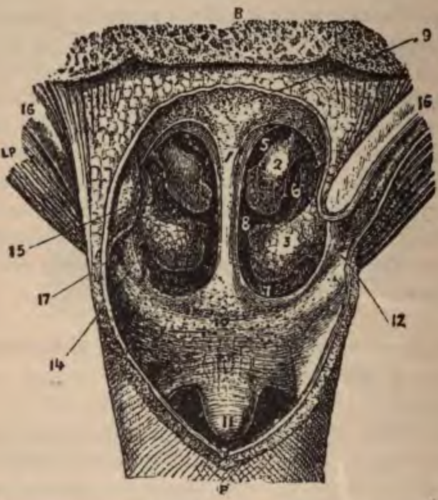
How are the posterior nares examined?

Posterior rhinoscopy is to all intents and purposes the same process as laryngoscopy, except that a smaller mirror must generally be *used*, the reflecting face of which is turned upward instead of downward. The tongue, also, instead of being drawn forward with a napkin, is held down by means of a tongue depressor. The relative position of patient and observer is the same as in laryngoscopy, except that the patient's head is not bent backward, but is either held perpendicularly or is inclined slightly forward. The rhinoscopic mirror having been warmed, should be introduced into the pharyngeal cavity behind the velum palati, and so placed as to reflect the light upward and forward into the vault of the pharynx and into the posterior nares. For this purpose a No. 1 mirror is generally most useful, but a larger mirror can sometimes be used to advantage, and should always be employed when the space between the palate and pharynx is sufficient to permit it. Posterior rhinoscopy is much more difficult than laryngoscopy; but, except in the case of young children, patience and dexterity will almost always enable the observer to obtain a glimpse of the various parts of the posterior nares and vault of the pharynx without the use of accessory instruments. When disease of these structures exists, or posterior hypertrophies or other neoplasms are present, the examination is usually easy because of their interference with the motion of the palate.

What are the chief obstacles to posterior rhinoscopy?

In many cases the palate will rise forcibly as soon as the mirror has been introduced, thus completely shutting off the view of the parts above. This difficulty can often be overcome by requesting the patient to breathe through his nose or emit a nasal sound like that of the French letter N. The observer should in all cases avoid touching the back of the tongue or pharyngeal wall, as otherwise gagging and retching immediately occur, and further examination is rendered futile. Excessive irritability of the palate and pharyngeal wall can usually be relieved sufficiently to permit an examination being made with the rhinoscope by painting the parts with a four per cent. solution of cocaine. In operating, it is often essential to be able to watch the movements of the instrument in the posterior nares. Under such circumstances the ends of a piece of small rubber tubing, such as is used for drainage in small wounds, may be passed one through each nostril and out through the mouth. If, now, these ends are drawn tight and passed under that part of the tube which is outside the nose, they will be held in position, and a sufficient amount of elastic traction will be exerted upon the velum palati to draw it downward and forward away from the pharyngeal wall and maintain it in that position. There is at first some gagging and sneezing, which quickly subsides, when the tubing may be maintained in position for some minutes without great pain or inconvenience to the patient.

FIG. 71.



View of the posterior nares, the pharynx being laid open from behind. (*After Luschka.*)

B. Basilar process; P. Pharynx; 1. Septum; 2. Middle turbinated bone; 3. Inferior turbinated bone; 4. Superior turbinated bone; 5. Superior meatus; 6. Middle meatus; 7. Inferior meatus; 8. Main passage of nostrils; 9. Vault of the pharynx; 10. Cushion of the soft palate; 11. Posterior surface of uvula; 12. Ridge formed by levator palati (L. P.); 13. Salpingo-pharyngeal fold; 14. Salpingo-palatine fold; 15. Eustachian prominence or cushion; 16. Eustachian tube, closed on the left and laid open on the right side; 17. Eustachian orifice.

Describe the appearance of the posterior rhinoscopic image.

Except in cases of cleft palate, it is impossible to obtain a complete posterior rhinoscopic image, such as is shown in Fig. 71; but by varying the position of the mirror, the different parts may be brought into view and studied one after the other. Usually the first object seen is a triangular plate, with its apex downward—the posterior margin of the nasal septum (1). Above it is a mass of glandular tissue called the pharyngeal tonsil, while at each side lower down are the crater-like orifices of the Eustachian tubes (8). In front of these, and projecting toward the septum, are the posterior aspects of the turbinated bones. The middle turbinated bone is usually first brought into view, and rarely the dim outline of the superior turbinated bone may be distinguished above and in front of it. Below the middle turbinated bone the upper part of the inferior turbinated bone is readily perceived; but to see the lower part of this structure and the floor of the nose requires considerable practice in the use of the rhinoscopic mirror.

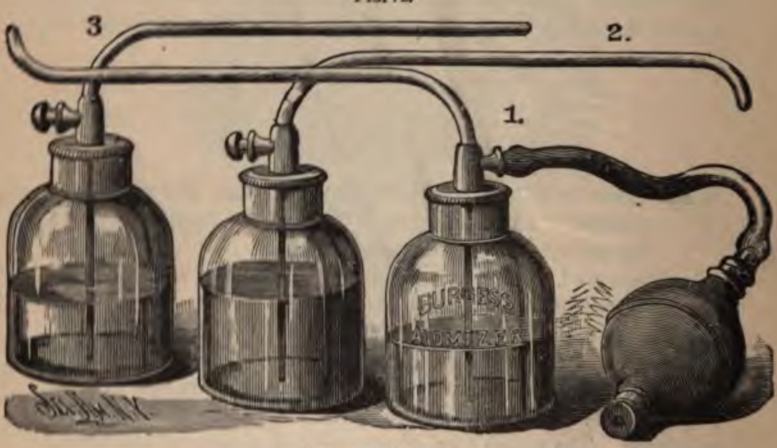
Accessory Instruments.

What other instruments besides those already described are necessary in examining and making applications to the interior of the nose and throat?

1. The sound. The laryngeal sound consists of a piece of silver wire, rounded at one end and inserted into a mirror handle. It should be sufficiently long to reach the anterior angle of the glottis without bringing the fingers holding the handle into the patient's mouth, and thus obstructing the view, and sufficiently firm to resist a considerable amount of pressure without bending. 2. The cotton applicator. The cotton applicator consists of a piece of aluminium wire of about the same size and length as the laryngeal probe, with roughened ends; so that a piece of absorbent cotton can be tightly wrapped around one end without fear of its becoming loose. This tuft of absorbent cotton will carry enough solution for any application within the laryngeal or nasal cavities, and, owing to its smaller bulk, is preferable to either a sponge or brush. 3. The atomizer. In most forms of throat and nasal disease, sprays are extremely useful, not only to cleanse the parts and remove accumulated secretions, but also as a means of spreading medicated solutions over a large surface. For laryngeal and post-nasal use, Sass' atomizing tubes are probably the best, as they throw an exceedingly fine spray either

upward or downward, or straight forward. In these atomizers the fluid to be atomized is sucked up through one tube by a current of air being forced past its contracted orifice from the other tube. The Burgess atomizer is, however, preferable for washing out the anterior nasal cavities, as it produces a continuous, coarse spray, when used with a rubber bulb. In it the air from the rubber bulb or reservoir enters the bottle of the atomizer and forces the fluid upward through the tube until it reaches the contracted orifice, where, by friction, it is broken up into a spray. Being made with metal tubes, these atomizers can, however, not be used for any fluid that would corrode them. They are made in three different patterns: one to throw a spray straight forward, one upward and one downward, and are to be preferred to the larger and more clumsy hard rubber instruments with movable or interchangeable tips. The air current necessary to produce the spray from the atomizers may be supplied either by the Burgess air compressor (Fig. 73), or by a rubber hand-bulb attached to the instrument. 4. The bottle inhaler. One of the simplest, but, nevertheless, a very efficient method of using solu*tions containing* volatile ingredients, is by means of the bottle inhaler.

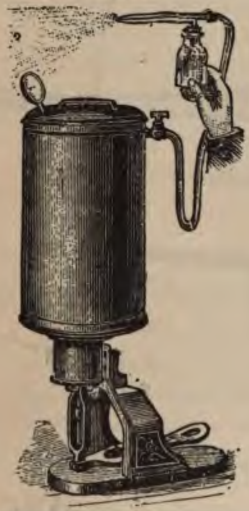
FIG. 72.



Burgess' Atomizers.

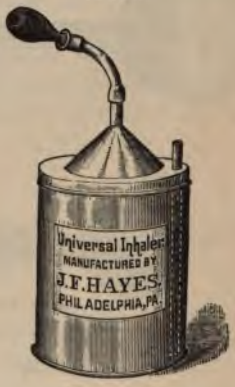
It consists, in its simplest form, of a wide-mouthed bottle, through the cork of which two glass tubes are thrust. One reaches nearly to the bottom of the bottle; the other passes simply through the cork, and is bent at the upper extremity. The bottle is filled one-third full of a solution, and the patient, by inhaling through the bent glass tube, causes air to bubble through the fluid and become impregnated with the volatile substances in the fluid before being drawn into the lungs. Mr. Hayes, a Philadelphia druggist, has devised a similar instrument of tin, which is very convenient when solutions have to be heated before being used. (Fig. 74.) 5. The powder blower. Remedies are often applied to the interior of the nose and larynx in the form of an impalpable powder. For this purpose the instrument illustrated by Fig. 75 will be found useful. The reservoir insufflator is also a very convenient instrument, which obviates the necessity of loading the powder blower each time that it is used. It has the disadvantage, however, of sometimes becoming tempo-

FIG. 73.



The Burgess Air Compressor.

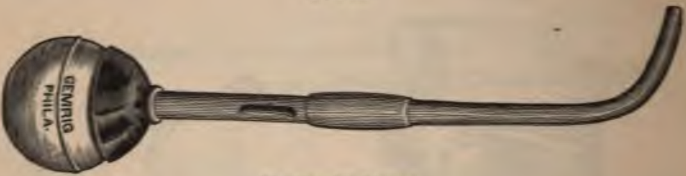
FIG. 74.



Hayes' Inhaler.

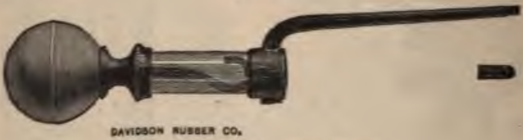
rarily clogged, and at the next attempt to use it discharges a much larger quantity of powder than is required into the patient's air passages. Sometimes a very large amount of powder will be unexpectedly thrown into a patient's larynx from this instrument, causing momentarily great distress and severe laryngeal spasm, which, however, quickly subsides, if the patient is given a glass of water to drink and told to hold his breath for a moment. Such accidents can, however, be avoided by care on the part of the operator.

FIG. 75.



The Powder Blower.

FIG. 76.


DAVIDSON RUBBER CO.

The Reservoir Powder Blower.

Examination of Patients.

What is the best method of examination to be adopted for patients?

First listen patiently to the patient's story of his illness; asking judicious, but not leading questions, so as to elicit the facts of the case, such as the influence of his employment upon his health, or any inherited tendency that he may have toward disease of the nose and throat or chest. Examine the tongue, as to whether coated or clean, pale or flabby, or of a natural color and resistance; look for ulcerations or mucous patches upon the tongue or the inside of the mouth; and also notice the shape and condition of the teeth.

Having depressed the tongue, observe the palate and uvula, the anterior pillars and tonsils, the posterior pillars and posterior pharyngeal wall. Notice any change from the natural color, shape, or mobility of the parts, the presence or absence of foreign bodies or hardened secretions. The nose should next be examined by anterior and posterior rhinoscopy, and finally the laryngeal mirror should be introduced. In these examinations, notice the condition of the parts in the following order, viz., (1) color and condition of the mucous membrane; (2) size and shape of the part examined; (3) loss of substance by ulcers, etc.; (4) presence of foreign bodies, neoplasms, or accumulated secretions; (5) mobility of the parts and functional disturbances. During the examination, touch any suspicious swelling with the probe, so as to ascertain its mobility, and whether it is composed of bone, cartilage, or softer structures. As the examination progresses, the result should be jotted down in the "case book," and any deviation from the normal in size or shape, or the presence of neoplasms or foreign bodies sketched upon the margin of the page.

Physiology and Pathology of Mucous Membranes and "Catching Cold."

What are the physiological functions of the nose?

The terminal nerve fibres from the olfactory bulbs are distributed in the mucous membrane covering the superior turbinated bodies, the upper part of the septum, and the anterior and upper portions of the middle turbinated bodies. The mucous membrane of this "*olfactory portion of the nose*" is of a peculiar yellow hue, has no mobile cilia, and is less richly supplied with blood-vessels than that of the inferior and middle meati or "*respiratory portion of the nose.*" Abnormal dryness of the nasal mucous membrane or nasal obstructions of a kind to interfere with the free access of air to the olfactory portion of the nose, interferes greatly with the acuteness of the sense of smell. The nose also serves as an additional resonant cavity during vocalization, so that obstruction of the nasal chambers invariably produces a peculiar nasal intonation during speech. Perhaps the most important function of the nose is to warm, moisten, and free from dust the inspired air. In health the nose secretes about one pint of serum in twenty-four hours, mostly by a process of exosmosis from the numerous blood-vessels of the mucous membrane and erectile tissue; this serum, mingled with the secretions of the mucous glands, disappears when the parts are in a healthy condition, without the individual being made aware of its presence. The more watery portion saturates the inspired air with moisture; and, of the residue, part is re-absorbed and part swallowed, while the moist condition of the mucous membrane serves to catch and retain particles of dust floating in the inspired air.

What three forms of inflammation occur in mucous membranes?

Acute and chronic catarrhal inflammation; croupous inflammation and diphtheritic inflammation.

Describe these three forms of inflammation.

In acute catarrhal inflammation, an increased blood supply stimulates the epithelial layer of the mucous membrane to increased activity: new cells are rapidly formed and cast off, while the glands pour out their secretion in excessive quantities and an abundant liquor sanguinis transudes the vessels, the mucous membrane at the same time appearing red and swollen. Chronic catarrhal inflammation differs from acute catarrhal inflammation in that the sub-epithelial layer of the mucous membrane is more involved. Connective tissue is developed by a slow process of proliferation. Usually the mucous membrane is thickened and hypertrophied; but, in some instances, the new tissue may be so placed as to press upon the glands and follicles, giving rise to atrophy and the so-called atrophic or "dry catarrh." Also in catarrhal inflammation of a mucous membrane there sometimes occurs increased activity in the lymphoid cells, finally producing hypertrophy of the tonsils or other adenoid structures. Activity of morbid processes, confined largely to epithelial and lymphoid structures, belongs essentially to the younger period of life; while morbid activity in the connective tissue structures belongs essentially to later life, rendering it much more difficult to bring about a cure in the catarrh of an adult than in that of a child.

Croupous inflammation is of a higher grade than catarrhal; for, while it commences in the same manner, with increased blood supply.

rapid cell growth and proliferation, increased secretion, and a throwing off of immature cells, leucocytes, and liquor sanguinis, it differs from it in the fact that the exudate contains a large amount of fibrin and albumin, which coagulate upon the surface of the mucous membrane, forming a false membrane. This false membrane is at times so soft and almost granular in character, as to be easily removed with a soft brush. At other times it is tougher and difficult of removal; but, in either case, when removed, the mucous membrane is left intact or only deprived of some superficial epithelial cells. Diphtheritic inflammation is also characterized by the formation of a false membrane, but its pseudo-membrane permeates the mucous membrane so densely, that it can only be removed by bringing away with it the entire thickness of the mucous membrane to which it is attached, thus leaving the parts below completely denuded. A diphtheritic pseudo-membrane is of a dark grayish color, resembling somewhat an ordinary slough of the mucous membrane; in contra-distinction from a croupous membrane, which is of a bluish pearl color, with no appearance as of sloughing of the parts.

What changes take place in the secretions of the upper respiratory passages as the result of catarrhal inflammation?

The secretions are either increased or decreased in quantity, so as to either flood the parts or leave them unnaturally dry. It should be borne in mind that the normal secretion of the nasal mucous membrane is over sixteen ounces of clear watery mucus in twenty-four hours, a part of which, in health, passes unnoticed through the naso-pharynx down into the œsophagus and stomach. Only when by obstruction or irritation, due to any cause whatever, this easy outflow and abundant secretion is interfered with, do we perceive a thickening and an accumulation of the secretion of the mucous membrane, which is designated as phlegm, and is composed largely of epithelial cells in a state of fatty degeneration, mucous corpuscles, and the impurities filtered out from the inspired air. When mixed with pus or blood, the secretions become yellow, green, or brown in color; and if retained upon the mucous membrane for a sufficient length of time, the secretions become offensive, as the result of putrefactive changes.

What is the modus operandi of "catching cold"?

"Catching cold" is the result of a transient influence upon the vasomotor system of nerves, producing an uneven distribution of blood in the capillaries, especially manifesting itself as a congestion of the mucous membrane of the upper respiratory tract, followed in most instances by inflammation, swelling, and either diminished or excessive perverted secretion. It is probable that the phenomenon of "catching cold" is largely of a reflex nature, in which the peripheral sensory nerve fibrillæ of the skin and extremities perceive the abstraction of heat as a shock, and being afferent in their conductive function, convey the impression to their respective ganglia, whence it is reflected by means of the afferent vasomotor fasciculi to the vessels, causing their dilatation and the congestion, and finally inflammation of the structures containing them. This theory not only explains the ordinary phenomena of a "cold in the head," but also the pain of neuralgia and rheumatism suddenly produced by "catching cold." Dilatation of the vaso-nervorum, resulting perhaps in the effusion of serum, produces pressure upon a nerve within its sheath and consequent pain in the muscle or skin containing it.

Why is it that a chilling of the surface of the body will produce an inflammation of the mucous membrane of the upper respiratory tract?

The reason why the mucous membrane of the upper air passages is the most frequent seat of an inflammation due to cold or a chilling of the surface of the body is that the sudden change of temperature produces in the first place an effect upon the sensory nerve fibres in the skin, which impression is communicated to the vasomotor centres and consequently results secondarily in a contraction of the blood-vessels of that portion of the skin which has been affected. As there is a certain amount of blood in the vascular system at a given time, a sudden contraction of any portion of that system must, according to the law of hydrostatics, cause a corresponding dilatation at some other portion, which is that portion which is least able to resist the pressure. Inasmuch as our variable climate, the impurities of the atmosphere, and our artificial way of living have a tendency to weaken the capillaries of the upper air passages from early childhood, that portion of the human economy is therefore the region most liable to suffer from this unequal distribution of blood. There results first engorgement of the parts with increased secretion, and finally inflammation.

Diseases of the Nose.

Name the chief diseases of the nasal cavities.

Acute rhinitis or coryza, simple chronic rhinitis, hypertrophic rhinitis, atrophic rhinitis, syphilitic rhinitis, vasomotor coryza or hay fever; the various neoplasms—myxoma, fibroma, papilloma, cyst, ecchondroma, exostosis, sarcoma, and carcinoma; diseases of the septum—deviation of the septum, hæmatoma, abscess, and submucous infiltration of the septum; epistaxis, rhinolith, and foreign bodies in the nose.

What is the effect of disease of the nasal passages on other parts of the body?

The disease may extend to the pharynx, ear, or larynx by continuity of structure, or affect the other respiratory organs by abeyance of the functions of warming, moistening, and filtering the inspired air, so that it enters the pharynx cold, dry and dust-laden, thus producing disease of the pharynx, larynx, and even of the parts below them. Chronic laryngitis frequently results from this cause; and while it is difficult to prove that pneumonic phthisis is directly the result of atrophic rhinitis, yet it is difficult not to suspect some such relationship between the two diseases in the same individual. As the result of nasal disease there are often induced certain reflex phenomena, viz., nasal cough, nasal asthma, nasal vertigo, nasal epilepsy, nasal chorea, hay fever, pareses of the palate and larynx, neuralgia and headache, reflex skin rashes, affections of the eye, both inflammatory and muscular, and diseases of the ear.

The term "reflex" is, doubtless, often misapplied, yet it has a definite significance, and the reflexes which originate in nasal or naso-pharyngeal irritation and terminate in cough, laryngeal spasm, or asthma, follow much the same pathway as the reflex known as sneezing. The nasal branches of the ophthalmic division of the fifth nerve and the nasal branches of the anterior palatine descending from Meckel's ganglion, which is in connection with the superior maxillary division of the fifth nerve, conduct the sensory impressions to the medulla. It is there reflected to the respiratory, pneumogastric, and other centres, whence the deep inspiration, the forced expiration, and the coincident spasm of the pharyngeal and laryngeal muscles, termed a sneeze.

This mechanism, of course, varies somewhat with the different reflex acts, and in the group constituted by reflex pareses considerable complexity may enter by implication of the vasomotors through the superior cervical sympathetic ganglion.

Acute Rhinitis.

What is acute rhinitis?

Acute rhinitis is an acute catarrhal inflammation of the nasal mucous membrane.

What other names is it known by?

Coryza, cold in the head, acute nasal catarrh, and in children the snuffles.

What is its etiology?

It is generally the result of exposure to cold and wet when the body is overheated. It may, however, be produced by breathing hot dry air or inhaling irritating vapors and dust, errors of diet, or come on apparently as the result of a venereal debauch. Scrofula, syphilis, rheumatism, dyspepsia, or a debilitated state of the system renders an individual more liable to attack.

What is its pathology?

At first the mucous membrane, though swollen and congested, is dry. As the diseases progresses, there is an abundant serous discharge, which becomes more and more charged with broken down epithelial cells, lymph corpuscles, pus globules, etc., until the discharge assumes the character of a thick, tenacious mucus or mucopus. The deeper lying tissues also participate in the process. The erectile tissue becomes gorged with blood, erected and swollen, in some instances completely occluding the nares.

What are its symptoms?

The onset may be simply an attack of sneezing, followed by increased and thickened discharges. In other cases the attack begins with chilly sensations and a general feeling of illness. There is a sensation of fullness and pain about the nose and forehead. The face may be flushed, the eyes suffused, and more or less fever be present. Sensations, almost suffocating in their character, may be present from occlusion of the nares, and the discharges be so irritating as to scald the skin of the alæ and upper lip. A cold in the head lasts from two or three days to as many weeks. It generally ends in complete resolution, but frequently repeated is a common source of chronic nasal catarrh.

What is the treatment of acute rhinitis?

A cold in the head can often be aborted at its commencement by a hot bath and a bowl of hot lemonade at bedtime, followed in the morning by a saline purge and the wearing of extra warm clothing. The turgescence of the nasal mucous membranes and discharges can always be abated by the application of a four per cent. solution of cocaine. This effect of the cocaine can be kept up for several hours by spraying the interior of the nose with a four per cent. solution of antipyrin immediately after the application of the cocaine solution. If repeated every three or four hours, this treatment gives great and immediate comfort to the patient and cuts short the course of the disease, while a soothing snuff (Formula 19) used by the patient in the intervals between the applications adds much to the efficiency of the treatment. In severe cases the patient had better remain in bed, and the presence of fever requires the administration of aconite in small doses at frequent intervals.

Simple Chronic Rhinitis.

What is simple chronic rhinitis?

Simple chronic rhinitis is a catarrhal inflammation of the nasal mucous membrane, exhibiting but a slight tendency to spontaneous recovery.

What other names is it known by?

Chronic catarrh; subacute rhinitis; chronic cold; chronic coryza; rhinorrhœa.

What is its etiology?

It is generally the result of uncured acute rhinitis, or frequent attacks of coryza.

What is its pathology?

The mucous membrane of the nose presents precisely the appearance seen in acute rhinitis, only it is less swollen and less red in color. The discharge is either watery, if the upper parts of the nose, especially the mucous membrane of the middle turbinated bodies, are the parts most affected; or it approaches in character muco-pus, if the disease is mostly located in the lower parts of the nose.

What are its symptoms?

The symptoms are precisely those of acute rhinitis, only less pronounced. There is a feeling of fullness about the nose, a continual discharge, and the sufferer is continually "catching cold," when, of course, all his symptoms are increased in severity.

What is its treatment?

Ordinarily the tone of the system is below par and a tonic is indicated. In such cases, Formula 32 answers a most useful purpose as a tonic; while, if the bowels are sluggish, it is advisable to direct the occasional use of a saline cathartic. *Cleanliness* of the mucous membrane is of primary importance, and may be secured by the patient using, at home, twice a day, as a wash, either Dobell's solution (Formula 1), or Seiler's antiseptic solution (Formula 2). Each of these washes are alkaline, and hence render the mucus more fluid and easy of removal. In using a nose wash, the patient should bend forward and closing one nostril with a finger of one hand, sniff up the solution from the hollow of the other hand; at the same time raising the head, so that the wash will gravitate into the pharynx and mouth, whence it may be expectorated and the process be repeated through the other nostril. Used in this manner, a much more thorough cleansing of the Schneiderian membrane may be accomplished by the solid stream of fluid drawn up through the nostril than if the spray of a hand atomizer were employed. The patient may also effectually cleanse his nares by means of the *nasal douche;* but its use is sometimes suddenly followed by deafness, and *it is, to say* the least, a dangerous instrument. The frequent application of an *alterative* to the nasal mucous membrane also does good, and formulæ 7, 8 or 9 may be used for this purpose. The first of these solutions should be used as long as it produces a slightly irritating effect, and then the next stronger solution substituted. These solutions should be applied in the following manner: Wrap a small piece of absorbent cotton about the end of an aluminium applicator in such a manner that it lays perfectly smooth. Dip it into the solution and pass it along the floor of the nose, until the pharynx is reached; then, depressing the handle of the instrument, slowly withdraw it. In making such an application, it is important that the end of the applicator should always be felt to rest on the floor of the nose; for, if the end of the applicator enters the middle meatus, sneezing and pain result, and it will be found impossible to reach the pharynx with the application. After the application of the iodine solution, the use of some protective upon the nasal mucous membrane is advisable. This indication may be secured by means of a spray of fluid cosmoline or albaline, applied until the mucous membrane of the nose and naso-pharynx is thoroughly coated with it. The cosmoline also serves the purpose of "spreading" the application previously made; which, to all intents and purposes becomes, after the use of the cosmoline, an ointment, thoroughly coating the Schneiderian membrane.

A case of simple chronic rhinitis is then perhaps best treated in the following manner. The patient is ordered a tonic, instructed to wash out his nose night and morning, with either Dobell's or Seiler's solution (Formulæ 1 and 2), and to present himself at the physician's office at least twice a week, but better every other day, for treatment. After first cleansing the nose with a spray, from an atomizer filled with either Dobell's or Seiler's solution, the physician should make an application of the iodine solution, and follow it with a spray of fluid cosmoline or albaline.

What is its prognosis?

Untreated, chronic rhinitis may continue indefinitely and finally result in hypertrophic rhinitis, the pharynx, also, gradually becoming affected. Treated in the manner described above, a cure is frequently wrought in from three to six weeks.

Hypertrophic Rhinitis.

What is hypertrophic rhinitis?

Hypertrophic rhinitis is a chronic inflammation and hypertrophy of the nasal mucous membrane and submucous tissues, with permanent dilatation of the blood-vessels.

What other names is it known by?

Obstructive rhinitis, hypertrophic nasal catarrh.

What is its etiology?

It is invariably the result of long continued simple chronic rhinitis or frequent attacks of coryza.

What is its pathology?

While in long continued simple chronic rhinitis there is already some thickening of the epithelial layer of the mucous membrane, yet the disease only becomes hypertrophic rhinitis when the thickening involves the other elements of the mucous membrane and the submucous structures. As the result of frequent attacks of inflammation, infiltration occurs, which finally becomes organized, so that the thickened turbinated tissues cannot collapse as when normal, and remain permanently distended with blood. This thickening is most noticeable at the anterior and posterior parts of the middle turbinated bodies, where it is called an anterior or posterior hypertrophy. As the result of increased blood supply, ecchondroses and exostoses frequently occur upon the septum opposite the pendulous portion of the inferior turbinated bodies, thus increasing the nasal obstruction. Often a "bank" or "ridge" of cartilage and bone will extend nearly the whole length of the septum from the anterior to the posterior nares.

What are its symptoms?

The most prominent symptoms are those of nasal obstruction and want of proper drainage from the nasal cavities, thin secretions. When the obstruction is great and constant, the patient becomes a "mouth-breather." The inspired air, under such circumstances, not being properly warmed, moistened and freed from dust, in its passage through the mouth, causes dry lips, a coated tongue, follicular pharyngitis, and sometimes chronic laryngitis. When the nasal occlusion is complete, the face assumes a stupid expression on account of the constantly open mouth. Should the habit of mouth-breathing be acquired in early childhood and continued for some years, even the shape of the bones of the face is altered and the habit of mouth-breathing retained long after the nasal obstruction has disappeared. In most cases of hypertrophic rhinitis any position favoring the gravitation of blood into the hypertrophied parts is sufficient to cause their distention; hence, when the patient is in bed, first one nostril and then the other will become occluded according to which side of the body is lain upon. This is especially true when large posterior hypertrophies are present. Obstruction and suppuration of the nasal duct not unfrequently occurs, the pus flowing backward into the eye when pressure is made in the region of the inner canthus. An anterior hypertrophy of the middle turbinated body pressing on the septal nerve, which is a branch of the ophthalmic, frequently causes reflex eye symptoms, such as chronic conjunctivitis, slight paresis of accommodation, and irritable retina. The olfactory slit may become closed from hypertrophy of the middle turbinated body, and thus interfere with the sense of smell and also that of taste to a corresponding degree. Hearing may be gravely compromised from the pressure of hypertrophies upon the Eustachian tubes, the damming up of their secretions, or the extension of the disease to their lining mucous membrane. Headaches are often complained of, and a feeling of pressure or even of pain at the root of the nose, as the result of occlusion of the infundibulum or even the extension of the disease into the frontal sinus. The drainage from the nose being interfered with, collections of mucus undergo fermentation upon the floor of the nose, thus increasing the inflammation and obstruction.

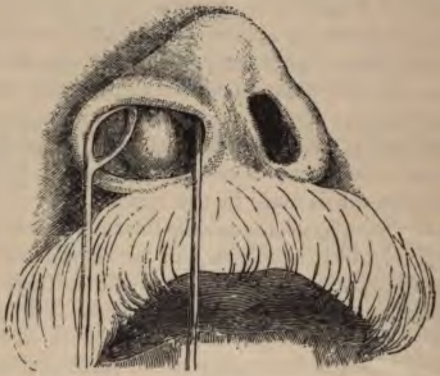
What is its treatment?

Each case should be treated as one of simple chronic rhinitis, until the inflammation of the Schneiderian membrane has disappeared, when operations should be undertaken for the removal of any tissue causing obstruction.

What operative procedures may be undertaken for the removal of anterior hypertrophies? (Fig. 77.)

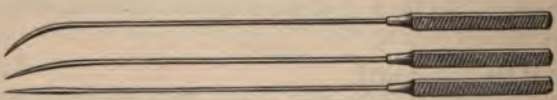
If large, the operation with Jarvis' needles and snare will be found most satisfactory. (Figs. 78 and 79.) Jarvis' snare consists of a small canula, about seven inches long, made of steel. About four inches from the lower end is a cross-bar, and the portion between this and the end is threaded and carries a screw-nut, which, by being turned, travels up or down. A portion of the circumference of this threaded part of the canula is filed flat throughout its entire length, and over it, behind the nut, slides a tube, which is fitted to the flattened screw, so as to prevent its turning around, and carries on its lower end two retaining pins and a screw cap, by means of which the ends of a wire loop are fastened. Thus it will be seen that by *turning the nut*, the tube will be pushed downward, and the wire

FIG. 77.



Nostril dilated by Bosworth's Dilator, showing anterior hypertrophy. (*Seiler.*)

FIG. 78.



Jarvis' Transfixing Needles

loop projecting from the distal end of the canula thereby made smaller, until it is finally drawn within the canula. The base of the hypertrophy should be transfixed with a needle, and the wire loop of the snare so placed that it surrounds the base of the hypertrophy beneath the needle. The loop being drawn tight, the milled nut of the instrument is turned slowly, until the wire loop has cut through the tissues. If the operation is done slowly, little or no hemorrhage results. Anterior hypertrophies of the middle turbinated body may be removed in the same manner; without, however, the use of a needle. Small anterior hypertrophies can be removed very satisfactorily by simply cutting through them with a sharp knife to the bone. This method is of advantage in children, where, as the result of eczema of the lip and alæ, and great inflammatory swelling of the skin and mucous membrane, it is difficult to do any other operation. If cocaine be used, the cutting causes no pain, and may be repeated as often as the cut heals, until the eczema and hypertrophy have disappeared, which often occurs within a few weeks.

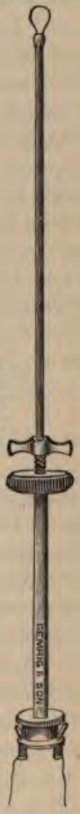


FIG. 79.

Jarvis' Snare.

Anterior hypertrophies may also be destroyed by means of chemical caustics. These applications are, however, so unsatisfactory in comparison with other measures at our disposal, that it is best not to employ them, unless nothing better is obtainable at the time of the operation.

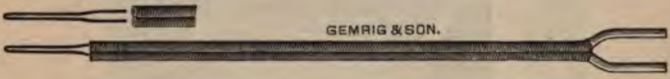
Perhaps the best method of removing anterior hypertrophies is by means of the galvano-cautery. A pledget of absorbent cotton, saturated with a 4 per cent. solution of cocaine, is introduced into the inferior meatus and allowed to remain in contact with the hypertrophy until it has shrunken as much as possible, and the parts are thoroughly anæsthetized. A conical metal speculum is introduced after the removal of the cotton, and the hypertrophy exposed. After the platinum wire of the cautery knife is at a dull red heat, it is placed upon the thickest part of the hypertrophy, and by means of gentle to and fro movements is made to cut through to the bone, when it is carefully withdrawn, so as not to detach the eschar which it has formed. The operator should be careful to cut down to the periosteum before withdrawing his cautery knife, or the results of the operation will be far from satisfactory. No after-treatment is required beyond keeping the wound as dry as possible, and endeavoring to avoid detaching the eschar before the healing process has been completed beneath it. Should, however, the eschar become detached, an antiseptic and astringent powder may be applied with advantage to the wound to form an artificial scab. The day following the operation there may be some inflammatory reaction, and the nostril occlude by swelling of the wounded hypertrophy, the patient feeling as if he had cought cold in that nostril; but this quickly subsides, *if all catarrhal inflammation has been removed before the operation was undertaken.* In order to perform this simple operation with satisfactory results, the electrode used should be of a somewhat different pattern than those usually offered for sale in the instrument stores. Indeed, the operator will find a certain advantage in making his own galvano-cáutery knives.

How should the galvano-cautery knife be made?

Select copper wire of sufficient diameter (No. 14 will do) so that it will not heat during the passage of the electric current, yet not so large as to take up too much room when the electrode is used through a nasal speculum. Cut the wire into lengths of about six inches. Get a jeweler to drill a hole in one end of each length, for the reception of the platinum loop, and bend the other end so that, when two lengths are bound together with silk, they will fit into the handle of the electrode. Holding a pair of such wires by their drilled ends, bind them firmly together by figure-of-eight turns of ordinary black buttonhole silk, being careful that each turn lies smooth and tight on and between the wires before the next is put on. When the bent ends of the wires are reached, fasten the ends of the silk by a few half-hitches. The copper wires are now ready to receive the platinum tip. Buy, at any dental supply store, some platinum wire. This should not be too thick, or it will not heat up readily, not having sufficient resistance; nor too thin, as in that case it will bend when an attempt is made to press it into the tissues. No. 22 is the size most useful. Bend a piece one and a half inches long sharply upon itself, and insert the ends into the holes drilled in the copper wires. Clamp the copper firmly on the platinum with pliers, and your cautery knife is made.

Most of the cautery knives for sale have the platinum soldered to the copper. This is a disadvantage, as they easily break at that point, necessitating frequent resoldering. Clamping the copper about the platinum does away with this disadvantage, while a few strokes with a file make a smooth joint. Before attaching the platinum loop to the copper, it may be made to assume any desired shape by a few blows from a hammer. An ordinary tack-hammer and flat-iron will answer the purpose of hammer and anvil, if one has nothing better at hand. A very convenient electrode for anterior hypertrophies in the nose is made by hammering one side of the bent platinum wire flat and leaving the other round. Hammering increases the resistance; so that the flat side of the loop will heat up more quickly than the round, and there is no danger of singeing the septum when such a knife is used. When it is desired to make a puncture rather than a cut, or cut only with the point of the knife, the platinum wire should be left nearly round, and only the very end or bent portion hammered. Then only the very end may be made red-hot. Such electrodes are convenient for cauterizing the middle turbinated bones or hypertrophied tonsils.

FIG. 80.

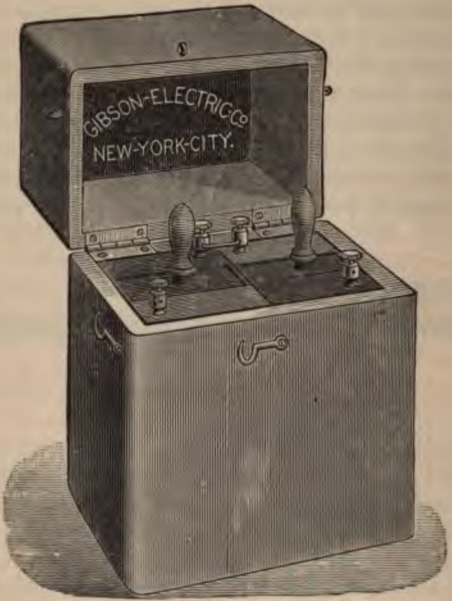


Galvano-cautery Knife.

What kind of a battery may be used in this operation?

Any galvano-cautery battery that is capable of heating the platinum wire of the cautery knife to a cherry red heat will answer, but a good storage battery is cheaper and cleaner, and less liable to get out of order than any primary cautery battery. Portable storage batteries can be obtained and may be charged from the wires of an electric light company, or from four or five cells of the ordinary sulphate of copper battery used in telegraphy. For office use, one cell of a Gibson stationary storage battery and four Watson sulphate of copper cells to charge it with electricity will be found a cheap, efficient and cleanly outfit. (Fig. 81.)

FIG. 81.



Gibson Storage Battery.

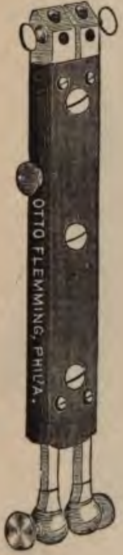
What kind of a handle is it advisable to select for the galvano-cautery knife?

Although most growths about the nose and throat can be more satisfactorily removed by means of the cold wire snare, yet there are occasions when a galvano-cautery snare serves a useful purpose, and it is probably best to select a cautery-knife handle made in such a manner that it can also be used as a galvano-cautery snare. (Fig. 83.)

How may posterior hypertrophies be removed? (Fig. 83.)

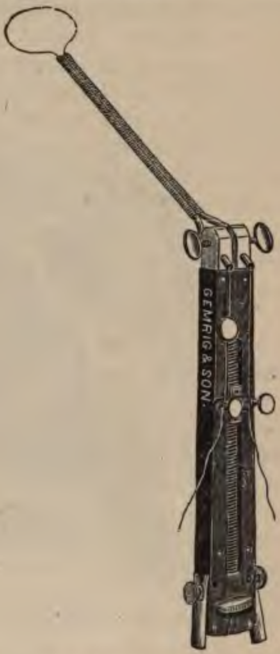
A Jarvis snare should be threaded with a rather thick piece of imported steel piano wire (No. 5 or 6), so that the wire will have sufficient resistance not to bend away from the base of the hypertrophy after it has engaged the growth. The loop of wire should be bent to one side before being introduced into the nostril, so that it may the more readily be passed around the hypertrophy and remain in position when the loop is tightened. Being made as small as possible without distorting it by pulling down the sliding tube

FIG. 82.



Flemming's Galvano-cautery Handle.

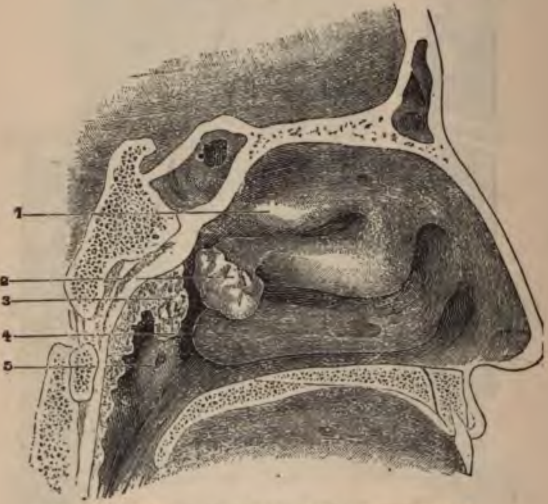
FIG. 83.



Seiler's Galvano cautery Handle with Galvano-cautery Snare.

upon the handle of the instrument, the loop is carefully introduced along the floor of the nose until the posterior wall of the pharynx is reached, when the loop is again enlarged by pushing upward the sliding tube, and the instrument at the same time is slowly withdrawn as its handle is carried toward the septum. By this means the wire is made to surround the hypertrophy, and a resistance is finally felt as the instrument is withdrawn, caused by the bight of the loop coming in contact with the base of the hypertrophy. The wire loop is now quickly tightened around the hypertrophy by pushing forward the instrument within the sliding tube, and the milled nut is quickly screwed downward into place. Two or three additional turns are given to the milled nut, to be certain that the wire is tight about the base of the growth and that the instrument is held firmly in place without danger of slipping, when the patient may be allowed to rest. The sudden tightening of the wire loop occasions

FIG. 84.



Posterior hypertrophy of the middle turbinated body.

the patient some pain, which, however, soon subsides, when the loop may be still further tightened by turning the milled nut, until the patient begins to again experience pain. In this way, proceeding slowly and carefully, the hypertrophy is finally squeezed off from its attachment and is generally removed clinging to the end of the instrument by some fibres that have been drawn down into it with the wire. Should, however, the growth not be removed with the instrument, no attempt should be made to dislodge it from the nose, as it forms an efficient plug to prevent hemorrhage, and will probably drop into the fauces and be expectorated within twenty-four hours after the operation. From thirty minutes to two hours should be thus consumed in removing a posterior hypertrophy, in order to prevent severe hemorrhage, which from its situation might be difficult to control; and the patient should sit awhile in the doctor's office before proceeding homeward, and should be cautioned against walking rapidly, violently blowing his nose or hawking and spitting. Ordinarily there is a very little blood lost at the time of the operation, and for some days afterward the patient expectorates a blood-tinged mucus. Owing to the compression of the wire, the wound made by snaring a posterior hypertrophy is but small and generally heals rapidly. Where there are several posterior hypertrophies present in the nose, a second operation may be done a week after the first. If a posterior hypertrophy is very small and sessile, it may more easily be removed if the operator waits until his patient has caught cold, when the swollen growth is more readily grasped with the wire. It is recommended by some authorities to watch the movements of the wire in the rhinoscopic mirror during the process of snaring. This very much complicates the operation and adds to its difficulties, and is absolutely unnecessary, as a good operator has his sense of touch so well educated that he has, as it were, an eye at the end of his snare, and can readily feel when the wire loop has engaged the growth. Besides, it has been shown by Bosworth that any structure in the posterior nares that can be grasped by the snare is pathological in its nature, and should be removed.

What are ecchondromata and exostoses of the septum?

A localized cartilaginous thickening or projection from the cartilaginous septum is called an ecchondroma, while a similar bony growth upon the bony septum is referred to as an exostosis. This latter name should not be confused with osteoma, a name given to rather a rare form of bony nasal growth which springs from the cellular tissue beneath the mucous membrane, and is not continuous with the cartilaginous or bony framework of the nose, and is therefore movable. Frequently ridges or shelves of cartilage and bone are found extending along the septum nearly from the anterior to the posterior nares. Usually such growths are opposite the lower turbinated body and encroach upon the breathing space of the nose.

What is their etiology?

They are doubtless sometimes merely provisional callus, that has been deposited upon an old fracture of the septum and has escaped absorption. The fracture may have been received during early childhood as the result of one of the numerous "bumps upon the nose" that children are constantly receiving. Most frequently, however, such outgrowths are the result of a local peri-chondritis or periostitis caused by the presence and *intermittent* pressure of a hypertrophied turbinated body.

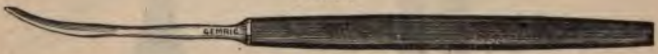
What symptoms do they cause?

Frequently nasal obstruction, sometimes with deviation of the septum toward the other nostril. Atrophy of the turbinated body opposite them is not uncommon, nor neuralgia of the whole side of the face as the result of inter-nasal pressure. Sometimes the crest of such growths is ulcerated, and a thin, irritating, sanious discharge results, impossible to cure except by the removal of the exostosis or ecchondrosis. The nostril being obstructed in front, the breath current is interfered with in such a way that there is a constant rarefaction of the air at the orifice of the Eustachian tube, and tinnitus, and finally otitis media and deafness result.

What operations may be done for the removal of these growths?

Localized thickenings of the cartilaginous septum may be cut through and removed by means of a small knife slightly curved upon the flat. (Fig. 85.) When the growth is hard and bony, it is best removed by means of a chisel or saw. The patient is prepared for operation by placing a piece of absorbent cotton saturated with a four per cent. solution of cocaine within the nostril. The cocaine should be allowed to remain in contact with the structures to be operated on for at least fifteen or twenty minutes, that its anæsthetic effects may penetrate as deeply as possible. After the removal of the cotton, the parts to be operated upon should be exposed by means of the author's dilator (Fig. 68), which will be found very convenient for operations within the nose, because when once in position it is self-retaining and not easily displaced by the struggles of the patient during an operation. It is introduced by holding the instrument between the thumb and first finger with the concavity of its spring upward, when the closed blades are introduced along the floor of the nose until they have disappeared within the nostril. The spring of the speculum is now carried upward over the nose until the blades of the speculum have grasped and distended the rim of the nostril, when, if necessary, the spring of the instrument may be hooked to a head-band upon the patient's forehead, thus elevating the tip of the nose so as to secure the best possible exposure of the part to be operated upon. If a chisel is to be used, the patient's head is made to rest against a firm support, and the edge of the chisel is placed against the anterior portion of the exostosis and made to penetrate as deeply as possible by pushing it forward with the hand. If necessary, the operation is continued by hammering upon the handle of the chisel with a lead mallet until the growth is felt to be severed from its attachment to the septum. Ordinarily, after the use of the chisel (Fig. 86), a few shreds of mucous membrane still bind the growth to the septum. These should be severed with angular scissors and the exostosis withdrawn from the nostril by means of Farnham's alligator cutting forceps (Fig. 87), or any other forceps that afford a firm hold without taking up too much room in the nostril. The advantage of the chisel operation is the quickness with which it can be performed; but after the first cut has been made, the nostril is deluged with blood and the

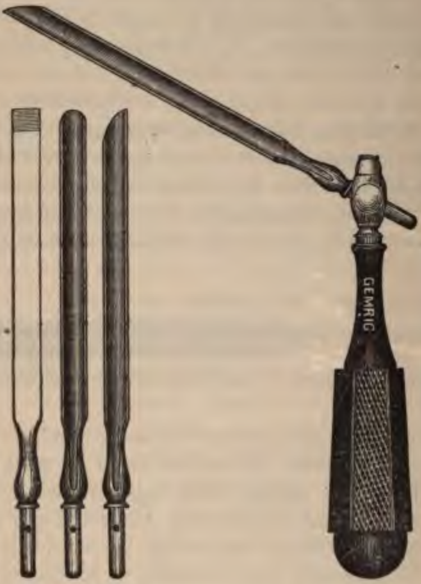
FIG. 85.



Cartilage Knife, curved upon the flat, for removing ecchondroses of the septum.

operator has to complete the operation entirely by the sense of touch, being careful to hold his chisel while hammering upon it, with its blade exactly parallel to the septum. When the saw (Fig. 88) is used, it should be entered *below* the growth and the sawing done in an upward direction, so as to obscure the field of operation as little as possible by blood, which, of course, flows downward from the wound. When the shelf of bone is large and hard, the operation is necessarily tedious; but at any stage of the operation the saw may be withdrawn and both operator and patient rest, a plug of absorbent

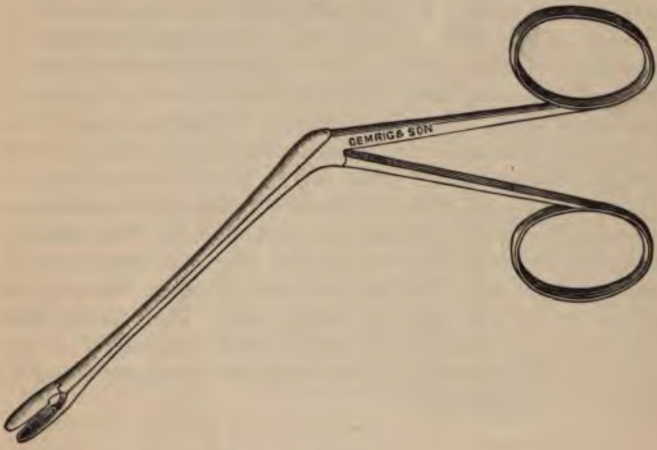
FIG. 86.



Seiler's Nasal Chisel and Gouges.

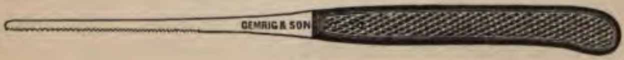
cotton saturated with a four per cent. solution of cocaine being again inserted within the nostril. Under these circumstances the cocaine acts as an hemostatic, and the probability is that the nostril will be found free from blood when the cotton is withdrawn, so that the operator can readily see to replace the saw in the cut already made. Whether the bony growth is removed by saw or chisel, the subsequent hemorrhage is usually but trifling and soon ceases spontaneously; but should this not occur, the hemorrhage can be controlled in a manner hereafter to be described. When an ecchondrosis or exostosis has attached itself to the inferior turbinated bone, so that a "bridge" extends

FIG. 87.



Farnham's Alligator Forceps.

FIG. 88.



Nasal Saw.

from the septum to the opposite side of the nostril, it is perhaps best removed by first sawing through the portion next the inferior turbinated body, then packing the nostril with absorbent cotton saturated with a four per cent. solution of cocaine to check all hemorrhage, and finally either sawing or chiseling away the attachment to the septum. Unfortunately, after such an operation, the "bridge" is very liable to recur, owing to the granulations from the cut surfaces of each side of the nostril approaching each other during the healing process, until they finally unite, forming a mass of granulation tissue, which, contracting, at length produces a much worse condition of affairs than existed before the operation. To prevent this disaster, a steel probe may be used to break down the adhesions, or a piece of tin foil may be worn inside the nose between the cut surfaces until the healing process is complete. But ordinarily the operations, either with saw or chisel, require no after-treatment beside the free use of an antiseptic wash (Formula 1 or 2) by the patient, in order to keep the wound clean. There is but little inflammatory reaction, and the wound heals promptly, *if all pre-existing nasal inflammation has been made to disappear before the operation was undertaken.*

Atrophic Rhinitis.

What is atrophic rhinitis?

Atrophic rhinitis is an atrophic condition of the nasal mucous membrane, usually also of the submucous tissues; and occasionally of the turbinated bones and septum. The disease is characterized by the formation of scabs and crusts, which frequently emit a fœtid and offensive odor.

What other names is it known by?

Dry catarrh, atrophic nasal catarrh, and, in children, scrofulous rhinitis.

What is its etiology?

Atrophic rhinitis is usually the result of long-continued hypertrophic rhinitis. An abnormal dryness of the atmosphere, like that produced by hot-air heaters, abnormal patulency of the nares, or anything else that causes a rapid evaporation of the nasal secretions, tends to produce atrophic rhinitis.

What is its pathology?

When the disease is the result of long-continued hypertrophic rhinitis, the pressure of adventitious cellular tissue causes absorption of the glandular elements. The surface of the mucous membrane being thus nearly deprived of its secretions, is exposed to dust and irritants of every kind that accumulate upon it, and with long-retained and inspissated secretions, form bad-smelling scabs and crusts. Owing to pressure from these scabs, shallow ulcers occur beneath them, while the atrophy progresses until, in some cases, the turbinated bones have nearly disappeared and the septum has become, at certain parts, almost as thin as a sheet of writing paper. It is not uncommon for individuals to present themselves to the surgeon with hypertrophic catarrh existing in one nasal cavity, whilst atrophic rhinitis is present in the other. In such cases, there is usually deviation of the septum toward the hypertrophic side. Cases are not infrequently seen with an inferior turbinated body and the adjacent mucous membrane atrophied, whilst the middle turbinated body immediately above is greatly hypertrophied, generally as the result of commencing necrosing ethmoiditis. In scrofulous children, the discharge may be thin and watery, and horribly offensive; the disease being then called ozæna.

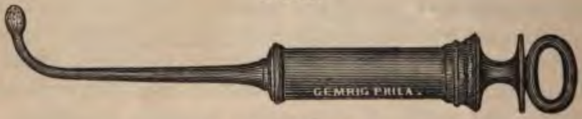
What are its symptoms?

A sensation of dryness and irritation within the nose and pharyngeal vault, with almost constant efforts to remove the accumulated secretions by hawking, spitting and blowing the nose. The breath is usually offensive from the putrefactive changes taking place in the slowly drying secretions. Upon inspection, the mucous membrane is found dry and glazed, with scabs and pus adhering to certain portions of it. Sometimes the nostrils are so patulous that the posterior pharyngeal wall can be plainly seen through them, and it also is usually in an atrophic condition. Reflex skin rashes and laryngitis are very common as the result of this affection.

What is its treatment?

The indications are to secure and maintain absolute cleanliness of the nasal mucous membrane, and replace, if possible, the atrophied parts. Cleanliness may be secured by the patient's use of an antiseptic wash. Formula 3 will answer very well for this purpose. It is often quite difficult at first to detach the scabs and inspissated secretions that adhere like so much glue to the vault of the pharynx and posterior nares. In such cases the post-nasal syringe answers a very useful purpose. (Fig. 89.) The nozzle of the syringe is introduced behind the velum palati, and the stream of fluid thrown with considerable force into the vault of the pharynx and posterior nares. Nitrate of silver seems to have an especial action in increasing the vascularity of the mucous membrane, increasing its secretions, and in producing renewed growth of atrophied tissues. Formula 12 may be employed with the powder blower for this purpose. Should a thorough application of the powder not be followed by momentary smarting, it does not contain a sufficiently large proportion of the silver, and Formulæ 13, 14, or 15 will yield better results. A snuff, containing a small proportion of argentic nitrate (Formula 13), may also be ordered for the patient to use himself at bed-time, but the powders containing the larger proportion of silver nitrate should only be employed by the physician himself, and should not be strong enough to cause more than a momentary smarting. The best results are obtained in the treatment of atrophic rhinitis by the use of cylinders of absorbent cotton, so placed inside the nose as to take the place to a certain extent of the atrophied turbinated bodies. If pharyngitis sicca is present, the cotton cylinders should be of sufficient length to extend the entire length of the nasal floor and project somewhat from the posterior nares. The presence of the cotton cylinders excites the atrophied mucous membrane to renewed action, so that the dried secretions are washed away in the increased discharge, and the fetor of the breath corrected.

FIG. 89.



Post-nasal Syringe.

The cotton cylinders soon become soaked with mucus, so that the air passing around and through them is warmed, moistened, and freed from dust, and enters the pharynx and larynx as if it had passed through a healthy nose. A cotton cylinder is easily made by wrapping absorbent cotton about the smooth wire shank of a laryngeal or rhinoscopic mirror until it has assumed the desired bulk and shape, when it may be slipped off the wire and deposited inside the nose. The patient should be taught how to make and place these cotton cylinders inside his nose, and should insert fresh ones, as soon as the old are removed, by the use of the handkerchief. If worn constantly, they cause an immediate change for the better in all the symptoms of atrophic rhinitis, and greatly stimulate the renewed growth of the atrophied tissues.

A case of atrophic rhinitis is then best treated in the following manner. At the first visit the naso-pharyngeal mucous membrane is thoroughly cleansed, and all scabs and adherent mucus removed, the post-nasal syringe and forceps being, if necessary, used for this purpose. Formulæ 12, 13, 14, or 15 is then thrown upon the clean mucous membrane with the powder blower, and cylinders of cotton placed in position inside the nose. The patient is ordered a wash and snuff for home use, is shown how to make and place the cotton cylinders, and requested to present himself at the physician's office, for inspection and treatment, at least twice a week. If pharyngitis sicca and reflex laryngeal symptoms are very annoying, Formula 29 may also be ordered with advantage to increase the secretions and diminish reflex action.

What is the prognosis?

Atrophic rhinitis is one of the most unsatisfactory and tedious of nasal diseases to treat. Fetor of the breath, and the other more annoying of the patient's symptoms, are easily and quickly corrected in the majority of cases, and a cure of the disease, although delayed, will be finally brought about by persistent effort.

Necrosing Ethmoiditis.

What is necrosing ethmoiditis?

Necrosing ethmoiditis is an inflammation usually resulting in necrosis of the inferior turbinated process and other parts of the ethmoid bone; characterized, after necrosis has occurred, by the presence of a tenacious, creamy white, muco-purulent discharge from sinuses or a cleft in the middle turbinated body, and usually by the presence of exuberant granulations and polypi, the result of the irritation of necrosed spicules of bone upon the surrounding soft tissues.

What is its etiology?

It is usually the result of catarrhal inflammation of the mucous membrane covering the middle turbinated body; the inflammation finally involving the periosteum and the bone beneath.

What is its pathology?

The mucous membrane of this portion of the nose extends inward to line the cells and trabeculæ of the middle turbinated body, and is inseparable as a membrane from the periosteum beneath. Inflammation of this muco-periosteum results in necrosis. Necrosed spicula of bone irritate the inflamed mucous membrane and cellular tissue, which, proliferating after its kind, forms large masses of granulation tissue and mucous polypi. These polypi partake more or less of a fibrous character in proportion to the amount of connective tissue involved in the proliferating process. The process of exfoliation is not always characterized by the presence of exuberant granulations or mucous polypi, but there is always a discharge of tenacious, creamy muco-pus, which adheres to the orifice of the sinus or cleft, from which it exudes. After the exfoliation of the necrosed bone, the disease frequently undergoes a spontaneous cure, a large crater or cleft in the middle turbinated body indicating the spot from which the dead bone has exfoliated. (Fig. 94.)

What are its symptoms?

An early stage of the disease is well represented in Fig. 90. A red and swollen middle turbinated body may press upon the septum, which ordinarily gives way before it, so that there is a deviation toward the healthy nostril. Should both turbinated bones be diseased, the septum, with its nerves, is nipped between the hypertrophied bodies, and reflex skin rashes upon the face, such as erythema or acne, or eye disease, or any of the reflex nasal symptoms previously mentioned, may be present. Fig. 91 represents a more advanced stage of the disease. In Fig. 92, "cleavage," with exfoliation of necrosed bone, is taking place, while from the cleft, polypi or proliferating granulation tissue protrudes. It is stated that nasal polypi may result from nasal obstruction and defective nasal drainage, or any other cause that favors a baggy and sodden condition of the mucous membrane of the upper part of the nose; yet it is rare to find nasal polypi without coexisting ethmoiditis, or evidence of its having existed at some previous time. Fig. 93 shows "cleavage" without proliferation of the soft tissues; the most common form of the affection. From the cleft or from a sinus in the bone, a creamy, tenacious mucus exudes, which the patient removes from his nose with great difficulty, while the use of a fine probe within the cleft or a sinus will lead to the detection of necrosed and exposed bone. At this stage of the disease, nasal asthma and cough, or paresis of

FIG. 90.

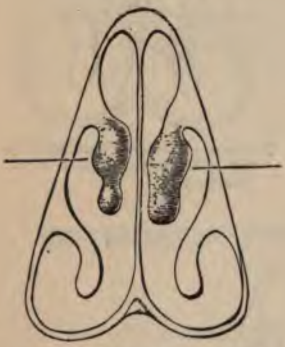
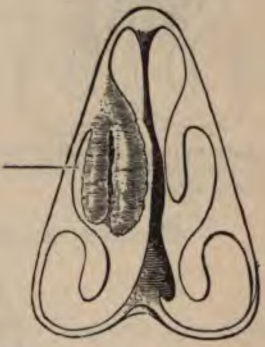


Diagram showing an early stage of necrosing ethmoiditis. (*Woakes.*)

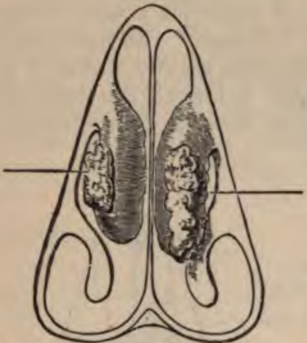
FIG. 91.



More advanced stage of the same disease, showing "cleavage" of the middle turbinated bodies. (*Woakes.*)

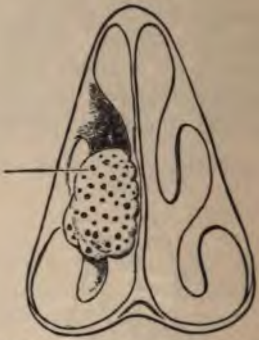
the soft palate are reflex symptoms often present. In some cases the introduction of a probe within the cleft is immediately followed by an epileptiform convulsion. Nasal chorea may also be present, most probably affecting only the orbicularis palpebræ and adjacent muscles of the face, but any of the reflex neuroses previously mentioned may

FIG. 92.



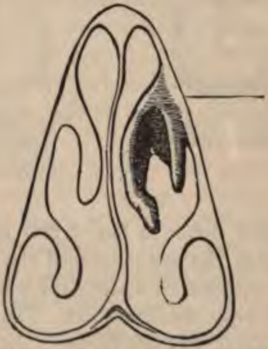
Granulation tissue protruding from the clefts in the middle turbinated bones. (*Woakes.*)

FIG. 93.



Polypus protruding from cleft in the middle turbinated bone. (*Woakes.*)

FIG. 94.



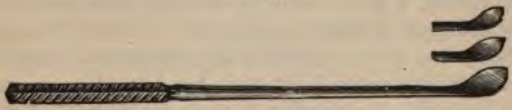
Crater-like cleft in the turbinated bone, resulting from necrosing ethmoiditis. (*Woakes.*)

be present at this stage of the disease. Fig. 94 shows the crater-like cleft presented when the disease has undergone a spontaneous cure.

What is its treatment?

Granulation tissue and polypi should be at once removed with the snare, and the parts scraped with the nasal curette. (Fig. 95.) The disease should then be treated as a simple chronic rhinitis. Applications of iodine solutions (Formulæ 7, 8 or 9) should also be made to the interior of the cleft and along any sinus from which pus is observed to exude. If, in spite of this treatment, "polypi buds" still continue to appear, a small galvano-cautery knife should be inserted into the cleft or along a sinus until dead bone is felt, and then brought to a red heat and slowly withdrawn; so as to produce an eschar extending from the necrosed bone to the surface, in the hope that when the slough separates, it will bring with it the offending necrosed spicules of bone. An attempt may also be made to remove the diseased part of the middle turbinated bone with the snare. Farnham's alligator cutting forceps will be found a very useful instrument to remove, quickly, polypus buds and small portions of the diseased bone. When the disease is deeply situated, the operator should remember the important structures by which the ethmoid bone is surrounded, and every operative procedure should be done with extreme care and gentleness, to avoid a serious or even fatal result.

FIG. 95.



Nasal Curette.

What is the prognosis?

The course of the disease, even under proper treatment and operative procedures, is generally tedious, but a cure is sooner or later brought about by persistent effort, while in some instances it may be quickly and easily obtained.

Coryza Vaso-motoria Periodica.

What is coryza vaso-motoria periodica?

Coryza vaso-motoria periodica is a chronic nasal affection depending upon a greater or less disturbance of the entire nervous system, and particularly of the various nerves supplying the nasal mucous membranes, and characterized by periodic exacerbations caused by inhaling dust or other irritants.

What other names is it known by?

Hay fever, hay asthma, autumnal catarrh, rose cold, horse cold, cow cold, peach cold, snow cold, miller's cold or asthma, are names given to the affection and supposed to indicate the irritant which is the direct cause of an attack of the disease.

What is its etiology?

There are really three factors in the causation of an attack of hay fever, viz.: First, a pathological condition of the nasal chambers; this may comprise anterior or posterior hypertrophies, exostoses, ethmoiditis; but more especially the presence of hypersensitive areas, readily distinguished by their heightened color and slight elevation above the surrounding mucous membrane. Irritation of one of these spots with the end of a probe, even during the winter time, will bring on an attack of hay fever lasting from half an hour to several days. Second, a diseased, or at least an irritable, condition of certain nerve centres, giving rise to a train of near and remote symptoms by reflex action. Third, the presence of an external irritant. *The absence of any one of these factors is sufficient to prevent an attack.*

What are its symptoms?

The premonitory symptoms of an attack of vasomotor coryza are those of coryza. A sense of dryness and itching in the nose, violent sneezing, occlusion of the nares and profuse watery discharge. These symptoms are usually followed by conjunctivitis, lacrymation, photophobia, headache often of a neuralgic character, a hacking cough, asthma, and a general feeling of malaise.

What is its treatment?

Nothing more than a palliative treatment should be undertaken while the attack lasts. The nose should be frequently washed with an alkaline antiseptic solution (Formula 1 or 2), and a four per cent. solution of cocaine on absorbent cotton applied to the swollen nasal tissues. After the use of the cocaine, a piece of fine surgical sponge should be fitted inside the nostrils. The sponge serves to filter the inspired air, and may be worn without discomfort both day and night. Large doses of quinine may be given with advantage, and, in the earlier stages, atropia (Formula 31) acts well in reducing the fever and limiting the amount of discharge. When asthma is present, iodide and bromide of potassium, of each ten grains three times a day, give good results, while morphia or antipyrin may be required for the neuralgic headaches.

After the attack has subsided, all pathological conditions of the nose should be removed and the sensitive areas cauterized with a small galvano-cautery knife, so introduced that its flat surface will rest upon the sensitive areas and make a *superficial* burn.

What is the prognosis?

It is not unfavorable. The patient should be kept under observation and occasionally treated for at least three years after an apparent cure, to prevent the danger of a relapse.

Nasal Hemorrhage.

What other names are there for nasal hemorrhage?

Epistaxis, rhinorrhagia, nose bleed.

What is its etiology?

Traumatism, such as blows, surgical operations, and picking the nose with the finger-nails, is the most frequent cause of nasal hemorrhage. It is a frequent symptom of nasal tumors or ulcerations within the nose. It may result from local congestion, weakness of the blood-vessels or obstruction to the general circulation. It occasionally occurs as a vicarious menstruation.

What is its pathology?

The great vascularity of the nasal mucous membrane readily explains the great frequency of nasal hemorrhage. In most cases of spontaneous origin, the bleeding is from the neighborhood of the septal artery, *i. e.*, from the anterior part of the septum. Wounds resulting from surgical operations upon this portion of the nose frequently bleed profusely, although an artery is sometimes observed to "spurt" in the wound of an operation done further back upon the septum, while spontaneous bleeding may occur from posterior hypertrophies or adenoid vegetations. In such cases the blood flowing downward into the fauces is expectorated, and is frequently mistaken for a hemorrhage from the lungs.

How can nasal hemorrhage be controlled?

The position of an individual has considerable influence upon the violence and duration of a "nose bleed" from which he may be suffering, and he should either assume a sitting posture or be well propped up with pillows in bed, except in cases of imminent syncope. Tightly closing the nostrils either with the fingers or absorbent cotton inserted just within the nostrils, by favoring the formation and retention of a clot, is often sufficient to control hemorrhage. When it is known that an artery has been wounded or evidences of weakness from loss of blood are apparent, mechanical means must be resorted to. If after an operation severe hemorrhage has occurred, and it is known from what spot the bleeding occurs, a small mass of absorbent cotton or "spunk," such as is used by dentists, may be tightly wedged within the nose over the bleeding vessel and by its pressure secure the desired result, or a cone of spunk may be passed along the inferior meatus until it has wedged itself over the bleeding vessel. When these measures do not succeed it may be necessary to "pack" the entire interior of that side of the nose from which the blood flows. Long strips of patent lint, which may be saturated with equal parts of water and Monsel's solution of the persulphate of iron, are well adapted for this purpose, as they are easily withdrawn from the nose after they have served their purpose. The end of such a strip is carried through the nose well back into the pharynx by means of a probe or pair of forceps, and as much as is necessary of the rest of the strip pressed tightly into the nostril until it is completely filled. The success of the measure depends upon the thoroughness with which the posterior nares are plugged; the operator should assure himself that the first part of the lint inserted rests against the posterior pharyngeal wall, and that, as he proceeds, the posterior narium is completely blocked. In most works on surgery an instrument called Bellocq's canula is figured, by means of which the posterior nares may be plugged by drawing a mass of cotton or other material through the mouth behind the soft palate; if at hand this instrument may be used. A simpler plan is to insert a Eustachian catheter through the nose and pass a fiddle-string or well waxed piece of stiff twine through it, until its end appears in the fauces, when it may be seized by a pair of forceps and drawn out through the mouth. A piece of absorbent cotton should then be tied to the middle of the fiddle-string or waxed cord, and drawn up behind the palate into the vault of the pharynx in such a manner that one end of the string projects from the nose and the other from the mouth. The ends of the string may now be tied together so that the cotton plug is firmly held in position. This procedure is seldom, if ever, necessary to check hemorrhage from the nose, but may be used where ether is administered, to prevent blood flowing into the pharynx during an operation upon the interior of the nose.

TUMORS.

Nasal Polypus.

What tumors are found within the nose?

Myxoma or mucous polypus, fibroma or fibrous polypus, cyst, ecchondroma, exostosis, osteoma, papilloma, angioma, sarcoma, and carcinoma.

In what respects do fibrous polypi differ from the soft or mucous polypi?

Instead of being soft, gelatinous and highly hygrometric, fibrous polypi are hard and fibrous. They usually have their attachment in the posterior portion of the nasal chambers, and may send prolongations into all of the adjacent cavities, either bending around obstacles or eroding their way through them, enlarging the nasal chambers, thinning the bones and broadening the bridge of the nose as they grow; causing great deformity, or what is sometimes called "frog face." Fibrous polypi are prone to degenerate into sarcoma, while mucous polypi do not display this tendency to so great a degree. Both mucous and fibrous polypi are probably local hypertrophies of the mucous membrane and submucous tissues that have undergone mucoid degeneration or fibrous change.

Describe nasal cyst or cystic polypus.

Nasal cyst usually occurs as a large sessile bladder, filled with a thin, watery, mucous fluid, and attached to the inferior turbinated bone.

What is the etiology of polypus?

Any long-continued irritation of the nasal mucous membrane may result in polypi. The most common causes are ethmoiditis or defective nasal drainage, as the result either of bony ridges on the septum, a deviated septum, or of hypertrophies of the lower turbinated bone, so that pent-up nasal discharges constantly keep the nasal mucous membrane in a soaked and boggy condition: the mucous membrane of the upper part of the nose being most prone to undergo polypoid degeneration from its pendent position.

What is the treatment?

Removal of the nasal polypi and the cause that produced them, in the manner described in the sections upon necrosing ethmoiditis and hypertrophic rhinitis.

Nasal Papilloma—Sarcoma.

Describe nasal papilloma.

Nasal papillomata are wart-like growths most frequently attached to the septum or inferior turbinated bodies. Nasal papillomata are generally abundantly supplied with capillaries, and some of them bleed at the slightest touch.

What is their treatment?

They should be removed with the snare and the place of their implantation touched with the galvano-cautery to prevent a recurrence.

Describe nasal sarcoma.

Sarcoma within the nose present the same pathological characteristics as when present elsewhere. It may occur as a primary growth, or result from the degeneration of fibrous polypi or papillomata. A nasal sarcoma is generally sessile and of a light reddish color. In children they grow very rapidly, and are prone to ulcerate with the result of producing a fœtid greenish or bloody discharge. Penetrating the surrounding structures, great deformity of the face often results. If growth occurs in an upward and backward direction, tinnitus, deafness and severe pain are usually present, while death may occur from final involvement of the brain in the disease.

What is the prognosis?

In children the growth ordinarily occurs so rapidly that an early fatal issue is to be expected, while in adults a slower growth makes early and complete evulsion practicable. The tumor will, however, return with increased malignancy if imperfectly removed.

What is the treatment?

Early and complete removal of the growth, of course, presents the only chance of recovery. Palliative treatment consists in the use of detergent washes and anodyne applications. A four per cent. solution of the muriate of cocaine may be applied on absorbent cotton to relieve pain, and Formulæ 17 or 18 applied with the powder blower for the same purpose and also as a disinfectant.

Nasal Carcinoma.

Describe carcinoma of the nose.

Carcinoma of the nose is of extremely rare occurrence as a primary affection, but may invade the nasal cavities from surrounding parts. It is usually of the epitheliomatous or encephaloid type.

What is the treatment?

Early and complete removal of the affected structures furnishes the only chance of a cure. Palliative treatment consists in cleanliness, nutrients, and the application of mild astringents to retard growth.

Syphilitic Rhinitis.

What is syphilitic rhinitis?

A diseased condition of the interior of the nose dependent upon the presence of syphilitic virus.

What other names is it known by?

Syphilitic catarrh or ozæna, specific rhinitis, and, according to the stage of the disease, syphilitic coryza, nasal gumma, tertiary nasal syphilis.

What is its pathology?

It is exceedingly rare to find the primary lesion of syphilis or chancre existing inside the nose, from the fact that the syphilitic virus is rarely introduced inside the nasal chambers, and that, should such an event occur, the secretions of the parts tend to wash away the morbid matter before inoculation takes place. Secondary lesions of the nasal mucous membrane are analogous to, and often coincide with, those appearing upon the skin. They vary from a mere erythema of the nasal mucous membrane with increased secretion to intense hyperæmia and swelling, with the presence of shallow ulcers, secreting a sanious and offensive muco-pus. During the tertiary period, nasal gumma are by no means rare. They appear as irregular nodulated swellings distending the mucous membrane of any part of the interior of the nose. A nasal gumma may be absorbed, leaving in some instances a characteristic cicatricial contraction, or it may break down and produce an ulcer, before which the cartilages and even the bony structures of the nose may melt away like wax as the ulceration rapidly extends, thus producing in a marvelously short time the most hideous deformity. When the ethmoid has thus been necrosed and exfoliated, there may remain, after the healing process is complete but a thin fibrous membrane between the interior of the nose and the brain. In other instances the septum, nasal processes of the superior maxillary, and the nasal bones may be partly destroyed in such a manner that the nose becomes flattened upon the face, producing a most serious deformity. In aggravated cases the soft parts may also be involved in the process, until finally the anterior nares are represented merely by an irregular hole in the face. During the ulcerative process of a gumma the breath is generally very offensive, while a peculiar odor emanates from the bodies of all syphilitic persons in whom the disease is active. Hereditary syphilis pursues the same course as the tertiary form of the acquired disease.

What is the treatment?

Constitutional treatment is of primary importance. The primary and secondary lesions are probably best treated by the internal administration of a pill containing one-fourth of a grain of the protiodide of mercury (Formula 22). The patient may take one of these pills three or four times a day, and a sufficient quantity of opium should be administered to prevent their producing diarrhœa. Any ulceration upon the nasal mucous membrane should be touched every other day with the acid nitrate of mercury: one part to four parts of water, until they are healed; and the inflammation treated in the meanwhile as a case of simple chronic rhinitis. In tertiary syphilitic rhinitis the "mixed treatment" answers a very useful purpose, for, while the iodide of potassium is not a specific in syphilis in the sense that mercury is, yet it gives a much quicker result in controlling tertiary manifestations. One, two, or three teaspoonfuls of Formula 21 may be given three or four times a day, according to the emergencies of the case and the patient's susceptibility to mercury. Mercury may also at the same time be administered by inunction or fumigation, or, in cases where the most speedy effects possible upon the syphilitic lesion is desired, it may be administered hypodermically. From eight to twenty minims of Formula 33 should be injected into the cellular tissue of the back every day or at less frequent intervals. If thrown into the cellular tissue of the back, a solution of corrosive sublimate, not stronger than that of Formula 33, will not produce an abscess, but causes some pain; which, however, quickly subsides, while the *insoluble* compound of mercury at first produced in the tissues is *slowly* absorbed and exerts a constant action upon the disease unattainable by any other method of using the drug, because of its rapid elimination from the system. But a few hypodermic injections are ordinarily required to limit the spreading of a gummatous ulcer, which speedily assumes a more healthy appearance. In cases where gumma are so situated as to cause obstruction to nasal respiration, pain, and intense headaches from pressure, the action of medicines upon the growth are too slow, and operative procedures must be resorted to. A gumma may be removed from a turbinated bone with the snare, or scraped from the septum with a large nasal curette. Such operations, however, should not be performed upon patients of debilitated constitutions, or those who are not, or cannot quickly be brought under the influence of mercury, as otherwise the wound made by the operation will not heal, and may result in extensive ulceration. When a nasal gumma has broken down and is ulcerating, the parts should be kept scrupulously clean by the use of an antiseptic solution (Formula 2 or 3), and the wound stimulated to heal by the daily application of acid nitrate of mercury diluted with four parts of water. Wounds resulting from operations upon gummata should be treated in the same way until the healing process is complete.

DISEASES OF THE SEPTUM.

Deviation of the Septum.

What is understood by deviation of the septum?

A bending of the septum to one side or the other in such a manner as to tend to render one nostril large and patulous and obstruct the other. It should be borne in mind that but few individuals have septums that are entirely straight, and unless the deviation is great enough to seriously obstruct one nostril, it can hardly be considered a deformity or as a cause of disease.

What is its etiology?

Traumatism is by far the most frequent cause. Inordinate growth of the septum or great height of the palatine arch, by which the floor of the nose and its roof are brought in closer proximity than normal, are frequent causes; almost all patients with deviated septums not the result of traumatism having abnormally high palatine arches. The septum may also be forced to one side by the growth of an exostosis or the pressure of a hypertrophy of one of the turbinated bones.

What is its pathology?

The deviation may be angular, or rounded, or S-shaped. The deviation may involve the whole or only a part of the septum. In all cases of sharp, angular deviation, hypertrophic changes occur at the apex of the angle, the narrowed nostril being still more obstructed by the bony ridge.

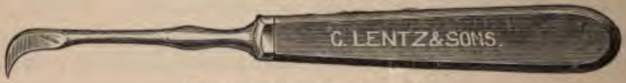
What are the symptoms?

There is usually some deformity, the tip of the nose being turned to one side or the other. The degree of obstruction in the narrowed nostril is, of course, in proportion to the deviation of the septum, and may amount to occlusion. At times there is complete obstruction to inspiration only from a valve-like action of the ala of the affected side, while expiration remains free and unimpeded. Naso-pharyngeal catarrh is usually present, due to the obstruction to the flow of the secretions anteriorly; which consequently, after accumulating in the nasal chambers, are after a time, hawked down through the naso-pharynx into the mouth and expectorated. Within the nostril, rendered large and patulous by the deviation, large hypertrophies of the turbinated bodies sometimes occur, thus reducing the cavity of that nostril to nearly its normal dimensions. Should this not take place, atrophic rhinitis occurs, generally followed sooner or later by pharyngitis sicca and chronic laryngitis.

What is the treatment?

When the presence of hypertrophies reduce the space within the dilated nostril to its normal dimensions, the attention should be directed entirely to the obstructed nostril. The removal of the hypertrophied angle of the deviated septum will often render the nostril sufficiently patulous to secure free respiration through it and bring about a cure of any catarrhal condition present. When, however, atrophic rhinitis is present in the nostril widened by the septal deviation, it will be necessary to restore both nostrils to their normal dimensions by straightening the septum, which is perhaps best done in the following manner: All bony and cartilaginous ridges having been removed at previous preparatory operations, the operator introduces his index finger into the obstructed nostril and forces it gradually back, fracturing and bending the septum into its normal position as he proceeds. A steel pin is now inserted through the skin on the bridge of the nose at a point near the end of the nasal bones, and being forced downward and forward between the finger and the septum, its point is finally imbedded in the floor of the nose, if possible in the suture between the superior maxillary bones. A few blows with a lead mallet serve to drive the point of the pin into the bone and render it perfectly firm. The head of the pin is then cut off about one-eighth of an inch above the skin of the nose, so as to prevent its disappearing beneath the skin when swelling occurs after the operation. When deviation of the septum is due to the septum being too large, it is best to make an incision through it at its place of greatest curvature, so that the edges of the cut will overlap when the septum is brought into its normal position. While the finger is still in the nostril, Harrison Allen's septum knife (Fig. 95) should be thrust through the septum in such a manner that its point will rest upon the tip of the finger. Finger and knife are now withdrawn together, so as to produce an incision through the septum of the required position and dimensions. The hemorrhage is usually but trifling and ceases after the pin is in place. The pin usually causes but little annoyance and should be allowed to remain in position for two or three weeks to serve the purpose of a splint. It is almost useless to attempt to retain a fractured septum in position by "plugs" of any material, as they cause so much irritation as to be almost unbearable. The after-treatment of the operation consists simply in keeping the nose clean with alkaline sprays and washes. (Formulæ 1 and 2.)

FIG. 95.



Harrison Allen's Septum Knife.

Hæmatoma of the Septum.

What is hæmatoma of the septum?

An extravasation of blood beneath the mucous membrane of the septum, generally the result of traumatism. It presents itself as a blood-red tumor, sometimes large enough to obstruct nasal respiration.

What is its prognosis?

The blood may be absorbed, or inflammation may occur and an abscess result.

What is its treatment?

If the amount of blood is large, an incision should be made to allow it to escape.

Abscess of the Septum.

What is the etiology of abscess of the septum?

Abscess of the septum may result from traumatism, syphilis or phlegmonous inflammation of the septum.

What are its symptoms?

There may be the history of a chill, followed by fever, as in abscess elsewhere. Upon inspection the nose is found to be obstructed by a soft, fluctuating tumor of the septum. Generally the septum is soon perforated, so that the tumor becomes bilateral.

What is the treatment?

Early evacuation of the pus to prevent extensive destruction of the parts involved in the inflammation, and hasten resolution.

Submucous Infiltration of the Septum.

What is submucous infiltration of the septum?

Submucous infiltration of the septum is a comparatively frequent accompaniment of chronic rhinitis, consisting of an œdematous tumefaction situated on each side of the septum, generally at its posterior portion.

What is its treatment?

If nasal respiration is obstructed, the masses may be scraped from the septum with the nasal curette, or cauterized with the galvano-cautery.

Foreign Bodies in the Nose.

What foreign bodies are sometimes found in the nose?

Children and insane persons occasionally insert into their noses buttons, cherry stones, beads, beans, twigs, hair pins, etc. Necrosed bones, when detached, act as foreign bodies and produce their characteristic symptoms. Rhinoliths, ascarides and maggots are also found in the nose, and may be considered as foreign bodies.

What are the symptoms?

Obstructed nasal respiration proportionate to the size of the foreign body. If the foreign body is large or causes pressure, headache and pain of a neuralgic character are complained of. At first the presence of a small foreign body in the nose of a child attracts but little attention, unless the child tells its parent that there is something in its nose. After a time a discharge of glairy mucus occurs, which excoriates the skin of the lips and alæ, but the discharge soon becomes purulent and may be streaked with blood and be fœtid.

What is the treatment?

The foreign body or bodies should be removed as soon as possible. This may be accomplished by means of a pair of forceps or Gross's ear curette. Rhinoliths may sometimes be removed whole, or may have to be broken up by means of a powerful pair of forceps in order to remove them from the nose. Chloroform will kill maggots, and its vapor should be inhaled when maggots are present, and the parts afterward cleansed with an antiseptic solution (Formula 2 or 3).

DISEASES OF THE PHARYNX.

What are the principal diseases of the pharynx?

Acute pharyngitis, chronic pharyngitis, follicular pharyngitis, atrophic pharyngitis, syphilitic pharyngitis, membranous pharyngitis, retropharyngeal abscess, tumors and paralysis of the pharyngeal muscles.

Acute Pharyngitis.

What is acute pharyngitis?

Acute pharyngitis is an acute inflammation of the mucous membrane and underlying structures of the pharynx.

What other names is it known by?

Acute sore throat, acute pharyngeal catarrh, angina catarrhalis.

What is its etiology?

Acute pharyngitis is generally the result of exposure to wet and cold, especially of persons of the rheumatic diathesis or of debilitated constitutions. It may also result from traumatism or the presence of a foreign body in the pharynx.

What is its pathology?

The inflammation is usually by no means evenly distributed, the glandular elements being always most affected. Their secretion is at first increased, but becomes after a time decreased, starchy and glue-like in character. The tonsils are always involved to a greater or less extent, their inflammation becoming so great in some instances as to mask the inflammation of adjacent structures, and the affection is then called tonsillitis or quinsy.

What are its symptoms?

The constitutional symptoms are usually trifling, a feeling of lassitude with slight fever. The throat feels sore, dry and stiff. The symptoms may increase until pain, especially when deglutition is attempted, becomes quite severe. The cervical glands are often swollen and painful to the touch. The voice is often husky, and a sensation, as of a foreign body in the throat, keeps the patient hawking and spitting. When the tonsils or larynx are seriously involved in the inflammation, certain other symptoms are present, which will be described further on.

What is the treatment?

A saline cathartic should be administered in sufficient quantities to secure one or more free movements of the bowels. A solution of nitrate of silver of the strength of one or two drachms of the salt to one ounce of water should be freely painted over the inflamed parts once or twice a day. It should be borne in mind that whilst the application of a weak solution of nitrate of silver to the inflamed fauces and pharynx is painful and acts as an irritant, the application of solutions of the strength of one or two drachms to the ounce of water is not painful, and is immediately followed by a sensation of relief and comfort, and tends to materially shorten the course of the disease. An astringent gargle or lozenge (Formulæ 26 and 27) should also be prescribed for the patient's use. When acute pharyngitis is the result of the presence of a foreign body, it should of course be at once removed, and the inflamed pharynx treated as ordinary acute pharyngitis. When the rheumatic diathesis exists, the administration of guaiac (Formula 28) will be found to yield most excellent results, whilst in gouty sore throat colchicum should be prescribed.

Simple Chronic Pharyngitis.

What is simple chronic pharyngitis?

Simple chronic pharyngitis is a chronic inflammation of the mucous membrane of the pharynx, generally the result of chronic rhinitis. The disease is often complicated by inflammation of the follicles of the mucous membrane, and is then called follicular pharyngitis.

What other names is it known by?

Chronic sore throat, granular pharyngitis, follicular pharyngitis, chronic angina, relaxed throat, chronic catarrh of the throat.

What is its treatment?

It is all-important to bring about a cure of the nasal disease to the presence of which the pharyngeal malady is due. After a cure has been brought about of the primary nasal affection, simple chronic pharyngitis will get well almost without treatment. During the treatment of the nasal affection, however, applications should be made to the vault of the pharynx of Formula 7, 8 or 9, in the following manner. A tongue depressor (Fig. 62 or 63) should be used to hold down the tongue and the patient requested to try to breathe through his nose, in order to relax the palatine muscles, when the application may be made without difficulty by means of an aluminium applicator, the end of which has been wrapped with cotton and bent to a suitable curve. Should, however, the palate lie closely in contact with the pharyngeal wall, considerable force will be required to carry the end of the applicator into the post-nasal space, while most of the solution with which the cotton on the end of the applicator has been saturated will be squeezed out and remain in the fauces. Applications made in such a manner tend rather to increase the existing inflammation than to subdue it, and it is always best to desist from making an application to the pharyngeal vault rather than employ force. When the uvula has become elongated or the mucous membrane of the fauces relaxed, as the result of constant "*hawking*," the daily application of the spray from an atomizer containing a solution of sulphate of copper, two grains to the ounce of water, will render material assistance in restoring the "relaxed throat" to a condition of health. In rare instances only is it necessary to amputate the elongated uvula.

Atrophic Pharyngitis.

What is atrophic pharyngitis?

Atrophic pharyngitis is an atrophic condition of the mucous membrane and submucous tissues of the pharynx.

What other names is it known by?

Pharyngitis sicca, dry pharyngitis.

What is its etiology?

Atrophic pharyngitis generally results from long contact with the irritating discharges of nasal catarrhs. It frequently exists when atrophic rhinitis is present, being probably the result of an extension of the atrophic process to the pharyngeal mucous membrane. A dry condition of the faucial mucous membrane, amounting almost to pharyngitis sicca, is found in all mouth-breathers, but disappears spontaneously as soon as the nose has been rendered sufficiently patulous.

What are the symptoms?

The patient complains of his throat feeling dry and stiff. Upon inspection, the mucous membrane of the throat appears light colored, thin and as if varnished. Frequently the mucous membrane is so thin that the outline of each cervical vertebræ can be distinguished. Sometimes masses of inspissated mucus, perhaps dark colored from the dust inhaled, and swept into ridges by the motions of the soft palate, are seen adhering to the atrophied mucous membrane.

What is the treatment?

Attention should be mainly directed to the condition of the interior of the nose, because it is the experience of most rhinologists that when a cure of the nasal affection has been brought about, the concomitant throat disease will get well almost without treatment. The general health should receive attention, and, if necessary, tonics should be prescribed; while a sluggish condition of the bowels may indicate the use of saline laxatives. Formula 29 may also be ordered to increase the pharyngeal secretions and diminish reflex symptoms. If atrophic rhinitis has caused the affection, plugs of cotton, previously mentioned as useful in atrophic rhinitis, should be made long enough to project somewhat from the posterior nares into the pharynx, while a weak solution of nitrate of silver (gr. v–xv to the f℥) should be applied to the atrophied mucous membrane, both above and below the soft palate, to stimulate the atrophied glands to increased secretion, and bring about renewed growth of the atrophied structures.

Syphilitic Pharyngitis.

What is syphilitic pharyngitis?

Syphilitic pharyngitis is an inflammation of the pharynx due to the presence in the system of the syphilitic poison.

What manifestations of syphilis are commonly met with in the pharynx and fauces?

The primary sore is not infrequently seen. Mucous patches are by no means rare, while gummata or their characteristic cicatrices are very often met with in the pharynx, especially in dispensary practice.

What are the symptoms?

In primary syphilis, examination shows a whitish abrasion, soon followed by swelling of the glands about the angle of the jaw. Secondary lesions may present either the form of mucous patches or erythema, characterized by a diffuse redness of the entire fauces, or more commonly in the milder attacks, by a broad red line extending upward upon each of the anterior pillars, and ending abruptly and symmetrically at the root of the uvula. These red lines are almost pathognomonic of syphilis, and persist for a long time after other secondary lesions have disappeared. In secondary syphilis the larynx almost always becomes involved, so that the voice is hoarse, and there is present a short cough of a peculiar metallic character, which once heard and recognized, is rarely forgotten. Mucous patches and erythematous patches in the throat are almost always symmetrical; that is both sides of the throat are attacked in corresponding localities by similar lesions, while tertiary lesions do not as frequently present this symmetry. Gummata more frequently involve the tonsils or soft palate than other parts of the throat. A gumma may be absorbed under treatment, or breaking down, result in a rapidly spreading ulceration. When an ulcerating gumma is situated upon the posterior wall of the pharynx, the cervical vertebræ, or even the cervical cord itself may finally become involved, and a fatal issue quickly result. In such cases also the utmost care is required to prevent union of the soft palate and uvula to the pharyngeal wall, when the ulceration has also involved the posterior surface of the palate. Where union has actually taken place, it is almost impossible at any subsequent period to permanently restore satisfactory communication between the oro-pharynx and naso-pharynx by any operation, because of cicatricial contraction after the operation.

What is the treatment?

In pharyngeal syphilis, as in syphilis elsewhere, constitutional treatment is of primary importance, and the same remedies may be employed internally, as already recommended in the treatment of nasal syphilis (Formulæ 21, 22, 23, 33). If the symptoms are urgent, the hypodermic method of administering mercury should be employed, as it gives the most speedy results. Local treatment consists in maintaining perfect cleanliness of the diseased parts, and stimulating mucous patches and ulcerations to heal by daily applications of the acid nitrate of mercury, diluted with five parts of water, and the application, by means of the powder blower, of a small quantity of Formula 17 or 18.

Retro-Pharyngeal Abscess.

What is retro-pharyngeal abscess?

Retro-pharyngeal abscess is an abscess of the posterior pharyngeal wall. It may be hidden above and behind the soft palate, and

What is the treatment?

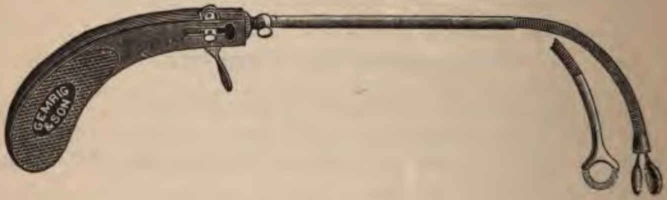
The central cause of the affection should be carefully sought and treated. In suitable cases, strychnia in gradually increasing doses until the limit of toleration has been reached, will do good; while arsenic and tonics are especially valuable where the paralysis is of diphtheritic origin.

Foreign Bodies in the Pharynx.

What two classes of foreign bodies are found in the pharynx?

First, those whose bulk does not allow them to pass through the œsophagus, and secondly, sharp-pointed objects, like pins, needles, fish bones, etc., that are forced into the pharyngeal walls by contraction of the constrictor muscles.

FIG. 96.



Seiler's Universal Forceps.

What are the symptoms?

Large objects may cause death by holding down the epiglottis. Sharp-pointed objects cause a pricking sensation, sometimes felt at two places in the pharynx, as in the case of a pin or needle. Localized spots of inflammation, when situated low down upon the pharyngeal wall give rise to the sensation of a foreign body, and this fact, as well as the imaginary foreign body of hysterical women, should be remembered after an unsuccessful search for a foreign substance in the pharynx.

What is the treatment?

It is not always possible to use the laryngoscope to advantage when the foreign body is situated low down in the pharynx, and in such cases the finger should be introduced into the pharynx, and if a foreign body be felt an effort should be made to scratch it loose with the fingernail and withdraw it. When the offending substance can be seen, a pair of forceps, either straight or curved, according to its position, should be used to withdraw it. Seiler's universal forceps (Fig. 96) is a very useful instrument for this purpose. It should be remembered that after the removal of a foreign body the sensation as of its presence remains for some days.

THE TONSILS.

Acute Tonsillitis.

What is acute tonsillitis?

Acute tonsillitis is an inflammation of the tonsils and adjacent structures.

What other names is it known by?

Quinsy, amygdalitis, cynanche tonsillaris, angina tonsillaris, angina faucium.

What is its etiology?

An attack of quinsy is almost always the result of an exposure to cold and wet, but a person who has once had the affection is rendered by it more liable to subsequent attacks. The rheumatic and gouty diathesis also plays its part in the production of an attack of acute tonsillitis. It is a disease of adolescence and early adult life, and does not very frequently attack individuals who are over thirty-five years of age.

What is its pathology?

The inflammation may be only superficial (erythematous tonsillitis), or may involve the parenchyma of the gland (parenchymatous tonsillitis). When the inflammation is deep-seated, an abscess may occur; but the brunt of the inflammation is frequently borne by the crypts of the tonsils, which pour out an abundant cheesy secretion, which, adhering to the surface of the tonsil, presents somewhat the appearance of a diphtheritic membrane.

What are its symptoms?

Dryness and stiffness in the throat is first noticed, soon followed by dysphagia. There is a chill, or chilly sensations, and pain in the legs and back, headache, and fever. As the disease progresses, the sufferings of the patient become severe. The dryness of the throat causes frequent attempts at swallowing saliva, which are exceedingly painful. The mouth can be opened only with pain and difficulty, and speech becomes almost unintelligible. The tongue is heavily coated and the breath intolerably fœtid. The hearing is frequently blunted from extension of the disease to the Eustachian tubes, and abscess of the ear sometimes results, while nasal breathing is usually entirely abolished. The fever, pain, and difficulty of swallowing become greater and greater, if an abscess is forming, and the relief is proportionately great after it has opened. As the patient expectorates the pus, he feels almost well, so great is the sense of relief, the fever and pain quickly subsiding together.

What is the treatment?

A thorough application of a solution of nitrate of silver, of the strength of one or two drachms to the fluid ounce of water, almost invariably aborts the attack, if applied early, and the inflammation is superficial. The silver solution should be freely painted upon the tonsils and adjacent inflamed mucous membrane by means of a swab of cotton. The relief experienced by the patient as the result of the application is almost instantaneous, and the application should be repeated once or twice a day, until all inflammatory symptoms have subsided. The nares and pharynx should be washed by means of a spray from an atomizer containing a detergent solution (Formulæ 1 and 2) before making these applications, and Formulæ 26 or 27 may be prescribed for the patient's use in the intervals between the applications. It is best also to open the patient's bowels thoroughly at the commencement of an attack by means of a saline cathartic. When these measures do not succeed in aborting the attack, but the fever and suffering of the patient are constantly increasing, aconite in drop-doses of the tincture every hour or every two hours will give most excellent results. When pus has formed, the abscess should be opened by means of a pair of blunt-ended scissors, and even where no pus escapes from the incision, the bleeding affords a certain amount of relief and may bring about resolution of the inflammation.

Chronic Inflammation with Hypertrophy of the Tonsils.

What three varieties of chronic hypertrophy of the tonsils are met with in practice?

First, the ordinary soft hypertrophy of the tonsils found in children and young adults. Second, the so-called ragged tonsil, the result of frequent abscesses, which have caused the sloughing away of a portion of the glandular mass; and, thirdly, the scirrhus or hard tonsil, which is characterized by an enormous increase of the connective tissue of the gland and a canalicularization of its blood vessels.

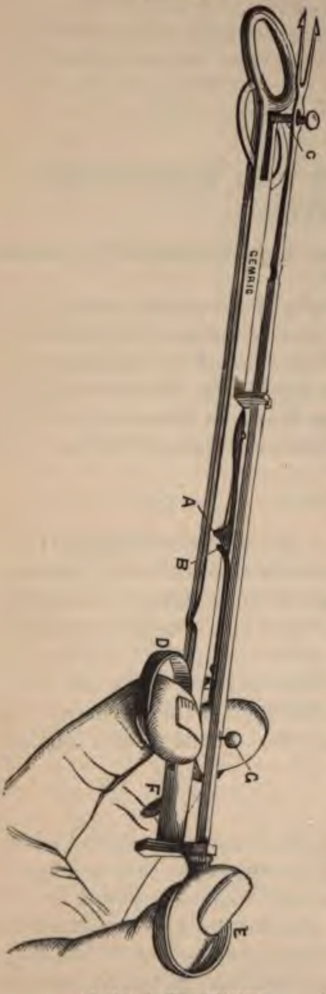
What are the symptoms?

There is generally more or less obstruction to breathing: the patient snoring during sleep. The articularization is what is termed thick, and there may be some difficulty in swallowing, especially in the cases of young children. The crypts of the tonsil may become filled with cheesy masses, which, undergoing putrefaction, imparts to the breath an offensive odor. Hypertrophied tonsils also sometimes interfere with the proper performance of the functions of the Eustachian tubes and thus are the cause of aural catarrh and deafness.

What is the treatment?

Removal of the major portion of the hypertrophied gland, either with the tonsillotome or snare or by means of the galvano-cautery. Occasionally the operation with the tonsillotome is followed by dangerous hemorrhage. Care should be taken not to wound the anterior pillar of the fauces, as it contains a small artery, which, when wounded, gives rise to troublesome bleeding. When the anterior pillar is adherent to the tonsil, it should be carefully separated from

FIG. 97.



Mathieu's Tonsillotome.

it by means of a probe, and, where this is impossible, the galvano-cautery should be used rather than the tonsillotome. When from any cause it is impossible to make the tonsillotome work to advantage, the wire snare of Dr. Jarvis (Fig. 79) can sometimes be used to advantage, but the operation is then much more painful and tedious than when the tonsillotome is used. Scirrhous tonsils should not be removed with the tonsillotome as, owing to the canalicularization of the blood-vessels, a wounded artery cannot contract, and the hemorrhage is usually long continued, and may be profuse and alarming. Should an artery be observed to spurt after an operation upon the tonsils, the bleeding spot should be pierced with a tenaculum, by twisting which a sufficient amount of torsion can usually be made upon the tissues to stop the hemorrhage until more efficient methods can be devised to control it. In cases of long-continued oozing of blood from the cut surface of the tonsil, Formula 30 may frequently be used with success to control it, or the solid stick of nitrate of silver may be rubbed over the bleeding surface.

The operation with the galvano-cautery is performed in the following manner: a small galvano-cautery knife is introduced, cold, into one of the crypts of the tonsils, and being heated while in situ, is made to burn its way out. Two or three such burns may be made, at a sitting, upon a tonsil, and will be followed by considerable shrinking of the hypertrophied gland. But one of the tonsils should be operated upon with the galvano-cautery at any one time, and from five to fifteen such operations are required to reduce the gland to satisfactory dimensions.

Elongation of the Uvula.

What varieties of elongated uvula are there?

The whole mass of the uvula may be hypertrophied, or the organ may be dropsical. More frequently, however, merely the mucous membrane is relaxed and hangs as a conical tip below the uvula proper. In rare cases a warty growth is attached to the end of the elongated uvula.

What is its etiology?

It is generally the result of chronic pharyngitis, the constant hawking to dislodge masses of mucus from the pharynx having a tendency to cause the affection. Paralysis of the palate is a frequent symptom in necrosing ethmoiditis, and in such cases paralysis of the azygos uvulæ muscles and consequent elongation of the uvula are concomitant with the affection.

What are the symptoms?

Patients complain of "a tickling in their throats." The elongated uvula hanging in contact with the base of the tongue causes an almost constant short cough as an effort to dislodge a supposed foreign substance. These efforts are sometimes persisted in until nausea and vomiting result. Snoring is usually marked and the sleep is disturbed by dreams.

What is the treatment?

The redundant portion of the uvula should be amputated if necessary (see page 219). The operation is perhaps best done in the following manner. The uvula is grasped with a pair of dressing or polypus forceps at a point just below where it is decided to amputate.

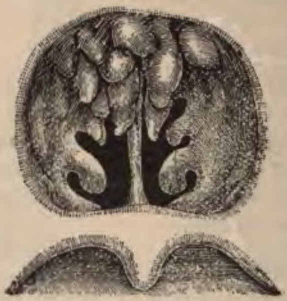
The uvula is stretched well forward and cut off close to the forceps by a single cut of a pair of somewhat heavy scissors, curved upon the flat, and held with their concavity upward in such a manner that the uvula is cut somewhat obliquely upward ; and the wound being upon the posterior surface, is protected from contact with food during the healing process. Generally there is but little inflammatory reaction and the wound heals promptly ; but occasionally a mild acute pharyngitis occurs when the uvula is thick and fleshy, as the result of the operation.

The Post-nasal Space or Naso-pharynx.

What diseases occur in the post-nasal space?

Post-nasal catarrh may be either secondary, as when a nasal or middle-ear catarrh discharges into the post-nasal space, or the disease may be primary and extend to either of those organs. The naso-pharynx may be blocked by posterior hypertrophies of the turbinated bodies, or by polypi, cysts, fibroid tumors, or malignant growths, springing from the posterior nares or from the vault of the pharynx. A somewhat common affection beginning generally in childhood is hypertrophy of the pharyngeal or Lusca's tonsil.

FIG. 98.



Adenoid Vegetations.

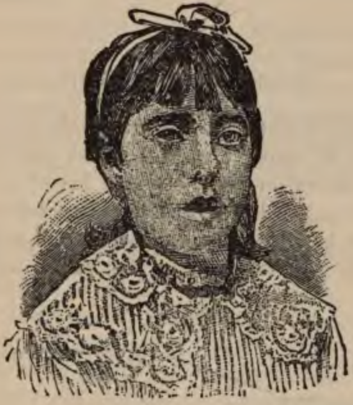
What is adenoid vegetations or hypertrophy of the pharyngeal tonsil?

Adenoid vegetations or hypertrophy of the pharyngeal tonsil (Fig. 98) is an overgrowth of the normal adenoid tissue of the pharyngeal vault. The affection is generally associated with hypertrophy of the faucial tonsils, and generally commences in childhood, but may be met with in patients of any age.

What are the symptoms?

If the adenoid vegetations are at all large, they block up the posterior nares and compel mouth breathing, the pinched nostrils and half open mouth giving the face a vacant and well nigh idiotic expression (Fig. 99). Breathing is audible, even during the day, and there is always loud snoring during sleep. The voice is toneless, articulation is indistinct and the hearing is more or less impaired.

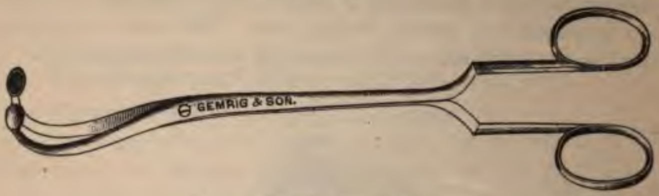
FIG. 99.



What is the treatment?

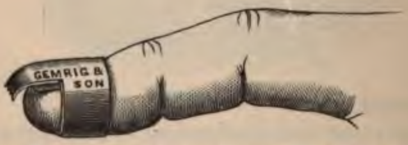
Adenoid vegetations tend to disappear of themselves as the individual passes through adult age, but may, in the meantime, have produced irreparable injury to the ears, and even have altered the shape of the bones of the face. Application of formulæ, 7, 8, or 9, to the post-nasal space, will sometimes bring about a slow absorption of the hypertrophied tissue, but the only treatment adequate in the majority of cases is a thorough removal of the mass by surgical procedures. Often the masses of adenoid tissue are so soft that they can be scraped away by means of the forefinger, introduced behind the soft palate. In adults Lowenberg's post-nasal cutting forceps (Fig. 100) may be used; the operator being careful to begin operating in the median line and work from it in each direction until the entire mass is cut and torn away from its attachment, at the same time being exceedingly careful not to wound the orifices of the Eustachian tubes. The operation by means of the finger-nail is done in the following manner: The child is seated crossways upon the lap of the operator, who holds down its upper extremities with his left arm and at the same time draws its body close to his own, so as to control its struggles as much as possible. His forefinger of the right hand should now be introduced behind the soft palate and carried upward along the posterior edge of the vomer until the vault of the pharynx is reached, when as much of the growth as possible is bruised and scraped away with the finger-nail. The hemorrhage is ordinarily but trifling, and as there is no reaction no after-treatment is required. In the case of children it is usually impossible to use the rhinoscope, and the finger must be used for purposes of diagnosis as well as treatment. In case the finger-nail of the opera-

FIG. 100.



Lowenberg's Post-nasal Forceps.

FIG. 101.



Artificial Finger-nail for removing vegetations from the vault of the pharynx.

tor should be found too short or too soft to sever adenoid vegetations from their attachments in the vault of the pharynx, the instrument figured in the cut (Fig. 101) might be made to serve a very useful purpose.

DISEASES OF THE LARYNX.

Anæmia of the Larynx.

When is the presence of laryngeal anæmia of especial importance?

1st. When associated with functional aphonia. 2d. When during the course of an attack of chronic laryngitis, the mucous membrane covering the arytenoid folds, arytenoid cartilages, and ventricular bands is abnormally pale while the vocal cords are the seat of indolent congestion, the patient not being generally anæmic. Each of the above conditions are premonitory of laryngeal phthisis.

Hyperæmia of the Larynx.

What is hyperæmia of the larynx?

Hyperæmia of the larynx is a congestion of the mucous membrane of the larynx, most marked where the sub-mucosa is loose, fat and thick, as upon the epiglottic folds, ventricular bands and ventricles; the epiglottis, vocal cords, and inferior cavity of the larynx being but little altered in color.

What is its significance?

Its presence renders an individual more prone to contract acute or chronic laryngitis.

What is its etiology?

Hyperæmia of the larynx is oftenest the result of excessive smoking, especially of cigarette-smoking. It also results from working in dusty rooms, and amid irritating chemical fumes.

Acute Laryngitis.

What is acute laryngitis?

Acute laryngitis is an acute inflammation of the mucous membrane of the larynx, sometimes extending to the submucous tissue and muscles.

What other names is it known by?

Mucous laryngitis, catarrhal laryngitis.

What is its etiology?

Acute laryngitis is generally the result of exposure to wet and cold, the same causes that produce an ordinary coryza, acute laryngitis being in many instances simply an extension of the disease downward. Many individuals have a hereditary or acquired tendency toward laryngeal inflammations. The affection also occurs as a complication in measles, variola, scarlatina, typhoid, rotheln and chicken-pox, and also as the result of traumatism; such as the inhalation of steam or irritating vapors. When acute laryngitis results from traumatism the inflammation frequently assumes the œdematous form of the disease, as the result of the submucous tissues being involved, while in children the croupous form is frequently met with, the mucous membrane of the larynx being covered with false membrane.

What are the symptoms?

The voice is altered in almost all cases, becoming in some almost aphonic, and its use extremely fatiguing and sometimes painful. In adults, the respiration is generally unembarrassed; embarrassed respiration indicating that the inflammation is assuming the more serious character of œdema. In children, on the contrary, embarrassed respiration is often the first symptom of the attack, the embarrassed respiration quickly assuming the spasmodic character of croup. The expectoration in adults is at first clear, frothy, muco-purulent, but somewhat scanty; abundant expectoration indicating that the disease has extended to the bronchi. Expectoration in children being always very scanty, probably explains why the paroxysms of dyspnœa are so severe and prolonged, the pain, tickling and sense of tightness in the throat being in them more severe. The color of the mucous membrane of the larynx as seen in the laryngoscope is always heightened, but varies in different parts of the larynx and according to the degree of the inflammation, the cords in slight attacks being quite white, while in severe attacks they are so red as to be scarcely distinguished from the surrounding parts. The ventricular bands are also sometimes so swollen as to entirely cover the vocal cords; or the cords may be prevented from approximation by swelling of the posterior glottic commissure.

What is the treatment?

It is well to begin with the administration of a saline cathartic. The patient should remain in a warm room, avoid using his voice, and an application should be made to the interior of the larynx once or twice each day, of a sedative and slightly astringent powder (Formula 18), by means of a powder blower, Fig. 75. In making such an application to the interior of the larynx, the patient is requested to grasp the tip of his tongue with a napkin and hold the tongue well forward. The operator holding the laryngeal mirror in his left hand, introduces the mirror into the fauces in such a manner that he sees the reflected image of the glottis. The powder blower should be held in the operator's right hand, and its nozzle is placed in the pharynx in such a position that it is seen reflected in the laryngeal mirror, and moved until it is observed to point toward the glottis. The patient is requested to say "a," and at the same instant the powder should be blown from the powder blower into the larynx. When an individual says "a" or, indeed, makes any other sound with his vocal organs, the cords are brought together in order to produce it; so that any application made at that instant is limited to that part of the larynx above the cords. Should it be deemed necessary to apply the powder to that portion of the larynx which is below the cords, it may be accomplished by using the powder blower while the patient holds his breath; or the powder may be carried deep into the bronchi, if the powder blower be used while the patient is performing the act of inspiration. After the more acute stage of the disease has passed, Formula 16 should be used instead of Formula 18, as an application to the interior of the larynx. In all cases of acute laryngitis, the inhalation of hot moist air answers a very useful purpose, and the patient should use at home a bottle inhaler or the instrument shown in figure 74. Th inhaler should be filled one-third full of hot water, to which may b added a teaspoonful of the compound tincture of benzoin, and shoul be used by the patient four or five times a day; the fumes of th benzoin as well as the moist warm air produced by drawing th breath through the hot water in the instrument, exerting a decidedl sedative effect upon the inflamed mucous membrane of the larynx.

Subacute Laryngitis.

What is subacute laryngitis?

Subacute laryngitis is an inflammation of the mucous membran of the larynx, subacute in character.

What is its etiology?

Subacute laryngitis commonly results from the same causes as th acute form of the disease. It generally attacks individuals of feebl constitution, or it may result from neglecting to treat properly th acute affection.

What is its treatment?

The treatment is the same as that of acute laryngitis, with th addition of tonics and sometimes cod-liver oil.

Chronic Laryngitis.

What is chronic laryngitis?

Chronic laryngitis is a chronic inflammation of the mucous membrane of the larynx.

What other name is it known by?

Chronic laryngeal catarrh.

What is its etiology?

It is generally the result of faulty use of the voice by singers o public speakers, and also of excessive smoking, especially cigarett smoking. The smoking of cigarettes is particularly injurious, not o account of the paper wrappers or any peculiarity of tobacco, but fro the habit all cigarette smokers soon acquire of inhaling the smok and bringing it directly into contact with the sensitive mucous membrane of the larynx. It is the very "mildness" of the smoke from cigarettes, in comparison with cigar smoke or that of a pipe, that make them more injurious. The convenience and cheapness of cigarettes, also, causes the cigarette-smoker to light a cigarette whenever he has a few moments to spare, and under circumstances when he would not think of smoking a cigar or a pipe, the ill effects of which are generally confined to the pharynx, and are most noticeable in those who, while smoking, indulge in frequent expectoration. Occupations that require working in a dusty atmosphere, and the frequent drinking of undiluted distilled liquors, are also causes of the disease, while the affection is sometimes simply the expression of the rheumatic diathesis. The presence of tumors inside the larynx may be classed as the result rather than the cause of chronic laryngitis.

What are the symptoms?

The voice is, as a rule, chronically hoarse, but the degree of hoarseness varies materially from time to time. In singers, the injury to the voice will be manifested in loss of range, diminished endurance, and loss of control. As the disease advances, all vocal efforts will be obviously strained and labored. Cough is by no means a constant symptom. The secretion is at no time very great in amount, and diminishes as the disease advances. It is thick, starch-like and tenacious. Small amounts of mucus frequently collect in the inter-arytenoid space, and, being suddenly detached by coughing, are thrown out through the mouth to a considerable distance, while little bridges of mucus are sometimes seen with the laryngoscope extending from cord to cord in the larynx. There is a constant feeling of constriction, as of a foreign body in the air passages. Upon inspection certain portions of the mucous membrane of the larynx appear redder than normal; and sometimes the entire mucous membrane of the larynx is of a uniform red color, with the exception of the cords, which may be somewhat lighter in color than the surrounding parts. The mobility of the cords is frequently impaired, either from swelling of the mucous membrane covering the arytenoids, or from slight muscular pain. Erosion of the inter-arytenoid space is frequently seen.

What is the prognosis?

Recovery from chronic laryngitis is always slow, and depends upon the faithfulness with which the treatment is carried out.

What is the treatment?

Constitutional remedies are not of the greatest importance; but, as in every other chronic affection, the general health should be improved as much as possible. Local treatment should consist of the daily washing of the affected mucous membrane with an antiseptic solution (Formula 1 or 2) by means of the spray of an atomizer, and the application of an astringent powder to the interior of the larynx, Formula 16 being most useful for this purpose. Inhalations of hot, medicated, moist air by means of the bottle inhaler may also be used by the patient at home. (Formula 34.)

Laryngitis Sicca.

What is laryngitis sicca?

In rare cases, catarrh of the larynx results in an exhaustion of the fluid elements of the laryngeal secretion. The disease is generally associated with atrophic rhinitis and pharyngitis.

What is its treatment?

When the disease is the result of atrophic rhinitis, the attention should be largely directed to the cause of the affection; but daily applications of a small quantity of either Formula 12, 13, 14 or 15, according to the nature of the case, should be made to the interior of the larynx, and the patient otherwise treated as a case of simple chronic laryngitis.

Inflammation of the Submucous Tissue of the Larynx.

What is acute œdema of the larynx?

Acute œdema of the larynx is a phlegmonous inflammation of its submucous tissue, frequently endangering life by occlusion of the rima glottis.

What other names is it known by?

Œdematous Laryngitis, Phlegmonous Laryngitis, Acute Œdema of the Larynx, Œdema of the Glottis.

What is its etiology?

Œdema of the Glottis may result from traumatism, such as the swallowing of corrosive liquids. It occurs rarely as a primary affection resulting from exposure to cold and wet in persons of debilitated constitution. In most instances, however, the disease is secondary, and results from Syphilitic or Tubercular Perichondritis, Retropharyngeal Abscess, Bright's Disease, Glycosuria, etc.

What is its pathology?

The infiltration consists essentially of a serous or sero-purulent fluid, most abundant beneath the mucous membrane of the ary-epiglottic folds, the ventricular bands, and the ventricles; because the submucous tissue is most abundant in these regions of the larynx; but the œdema is not always limited to that part of the larynx above the vocal cords, but may extend to the submucosa beneath the vocal cords. Infraglottic œdema, as the disease is then called, is almost invariably secondary in its origin, and always serous in character.

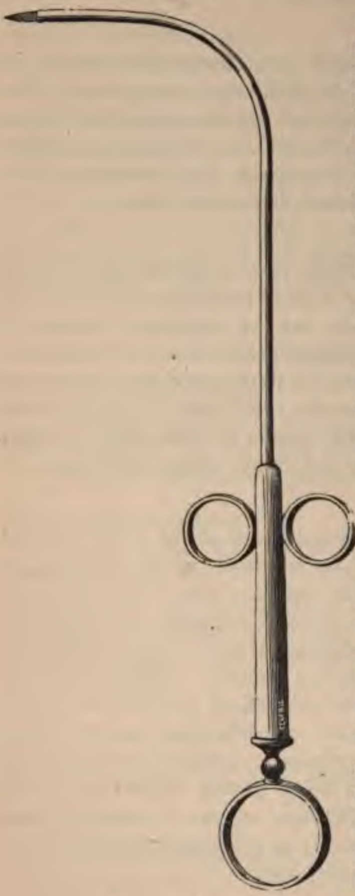
What are the symptoms?

In some cases there are no symptoms whatever prior to a fatal suffocation or syncope. The voice is usually rough and deep, or altogether lost, due to thickening and heaviness of the cords. In the early stages of an attack, the chief difficulty in breathing is during inspiration; but, as the disease advances, expiratory distress occurs, with the result of producing complete apnœa. A short cough is present and deglutition is both difficult and painful. When the œdema is considerable the sense of suffocation is most oppressive. With the laryngoscope, œdema is quickly recognized; the infiltrated portion of the larynx being greatly swollen and semitransparent in appearance. When the œdema is subglottic, the swollen mucous membrane of that region will almost always be seen of a more intense red than the cords above.

What is the prognosis?

Recovery from severe primary œdema is always doubtful, and the prognosis in secondary œdema depends upon the circumstances of the primary cause of the disease. The patient can hardly be said to be out of danger under two or three weeks from the commencement of an attack, and may even then become the subject of chronic infiltration. When death occurs it is almost always the result of carbonic acid poisoning, and may be the direct effect of stenosis or spasm of the glottis. Another danger is the possible occurrence of suppuration—Abscess of the Larynx.

FIG. 102.



Laryngeal Lancet.

What is the treatment?

Free diaphoresis should be produced in suitable cases by the hypodermic use of one-twelfth to one-fourth of a grain of pilocarpin. The temperature of the room in which the patient lies should be carefully regulated, and cold, dry applications kept upon the throat over the larynx. As soon as œdema is seen with the laryngoscope, local scarification with the laryngeal lancet (Fig. 102) should be performed. If, in spite of scarification and the use of pilocarpin, œdema continues with increasing respiratory distress, general enfeeblement and symptoms of blood poisoning, tracheotomy should be performed.

Laryngitis Syphilitica.

What is laryngitis syphilitica?

Laryngitis syphilitica is an inflammation of the larynx due to syphilis.

What other name is it known by?

Specific laryngitis, laryngeal syphilis, syphilis of the larynx.

What is its etiology?

Syphilis of the larynx most frequently occurs as a manifestation of the tertiary period; three to thirty years after the primary infection. As a manifestation of secondary syphilis, laryngeal symptoms may occur within a few weeks, or may not appear until two or three years after syphilis has been contracted.

What is its pathology?

In secondary syphilis, the laryngeal symptoms may consist of a mere hyperæmia, giving rise to the symptoms of simple laryngitis. Ulcerations may also be present, and are usually symmetrical. That is, if an ulcer is present upon one part of the larynx, there is usually a similar ulcer also upon the corresponding part of the opposite side of the larynx. Syphilitic warts or condylomata are also frequently found in the larynx during the secondary stage of syphilis. They may undergo ulceration or disappear spontaneously. Tertiary manifestation consists of gumma, which may break down and cause deep ulcerations, with perichondrosis and necrosis of the cartilages; while stenosis may result from cicatricial contraction after the healing of syphilitic ulcers.

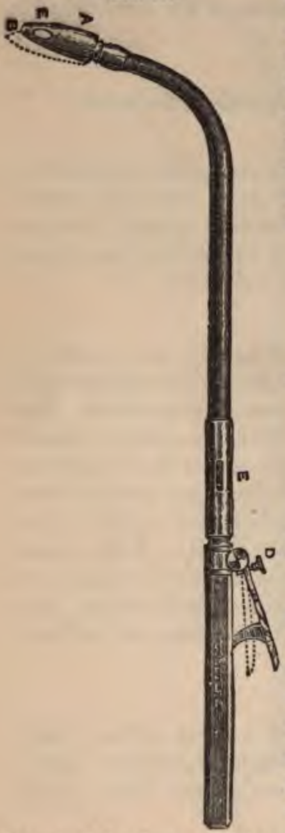
What are the symptoms?

The patient usually first complains of a slight hacking cough, hoarseness, and sometimes difficult and painful deglutition. Inspection with the laryngoscope reveals some of the lesions already specified.

What is the treatment?

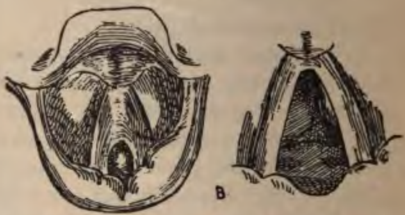
Constitutional remedies already mentioned (see Syphilitic Rhinitis) should be employed. The bottle inhaler, with compound tincture of benzoin, should be prescribed for the patient's use at home, in the same manner as for simple laryngitis, while an application of Formula 17 should be made to the interior of the larynx every other day with the powder blower. If shallow ulcers are present they should be touched each day with the solid nitrate of silver melted on the end of a probe. This may be accomplished by melting a few crystals of the nitrate on a silver coin and dipping the end of a cold silver probe into it. Enough of the silver nitrate will adhere to the end of the probe to make one application. If, however, the ulcers are deep, such applications will not be sufficient to secure healing of the ulcer. They should first be touched by means of the cotton applicator every other day with the acid nitrate of mercury diluted with five parts of water, application of nitrate of silver being made on alternate days. After a time, when the process of repair is beginning to set in, these applications become painful and should be omitted, but insufflations of Formula 17 should be continued until the larynx presents its normal appearance. Should partial stenosis

FIG. 104.



Brown's Hollow Laryngeal Dilator with cutting blade (one-third measurement).

FIG. 103.



Cicatricial Stenosis before treatment. The same after use of cutting dilator. (*Brown.*)

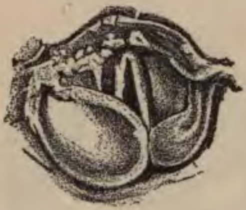
occur as the result of cicatricial contraction, the laryngeal stenosis may be overcome by the use of the laryngeal bougies or some suitable cutting instrument (Fig. 104).

Laryngitis Phthisica.

What is laryngitis phthisica?

Laryngitis phthisica is a chronic inflammation of the larynx due to the specific poison of phthisis, characterized by a peculiar ashy hue of the mucous membrane of the larynx, a pyriform swelling of the arytenoid cartilages in the early stages, and later on by turban-like swelling of the epiglottis, pseudo-papillomatous growths, or shallow ulcers in the inter-arytenoid space or other portions of the larynx (Fig. 105).

FIG. 105.



Laryngeal Tuberculosis with characteristic pyriform swelling of the arytenoid cartilages.

What other names is it known by?

Phthisical Laryngitis, Tubercular Laryngitis.

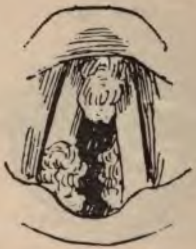
What are the symptoms?

The respiration is always more or less hurried, and becomes embarrassed in the later stages. There is a dry, hacking, painful cough, which in the later stages becomes looser, and the expectoration more abundant. Swallowing in the early stages is difficult, and in the later stages, painful. When the epiglottis or ary-epiglottic folds are ulcerated, pain during deglutition is felt in the ear on the same side most affected in the larynx. In the very earliest stages, the mucous membrane of the larynx is simply pale and anæmic, but later on the mucous membrane of the soft palate, as well as that of the larynx, becomes of a peculiar ashy-gray color, the arytenoids present a characteristic pyriform swelling, and the epiglottis becomes turban-shaped from deposits in the submucous tissue. Finally, ulceration occurs in the inter-arytenoid space and upon the cords, which present a peculiar "moth-eaten" appearance. The most characteristic appearance of laryngeal phthisis is the pyriform swelling of the arytenoids. Often one or both of them are swollen before physical examination reveals lung complications.

What is the treatment?

The treatment should consist, besides the administration of tonics, cod-liver oil and stimulants, in the local application of a sedative and anodyne powder (Formula 18) by means of the powder blower. When ulcers are present, great comfort may be given the patient by the application of a solution of nitrate of silver of from sixty to one hundred and twenty grains to the ounce of water. In the later stages of the disease, when the swallowing of food is exceedingly painful, a lozenge of gelatine, containing one-half a grain of the muriate of cocaine, dissolved in the mouth before each meal will enable the patient to take an adequate amount of food without great pain.

FIG. 106.



Laryngeal Papilloma.

What is the prognosis?

Inasmuch as the laryngeal symptoms are dependent upon the lung affection, the prognosis is of course unfavorable. Laryngeal phthisis rarely, if ever, occurs as an independent affection, and is probably always secondary to the lung disease.

Laryngeal Tumors.

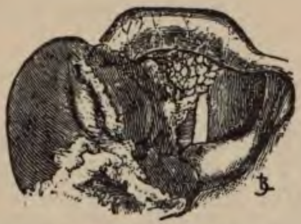
What tumors are met with in the larynx?

Papilloma, fibroma, angioma, myxoma, cyst, sarcoma and carcinoma.

What are the symptoms of a tumor within the larynx?

The most noticeable symptom is mechanical obstruction to breathing, and phonation proportionate to its size and location. If the tumor is small and situated upon a vocal cord, dysphonia results from interference with its vibration, while, if the growth is situated in the anterior commissure, between the cords, aphonia results from the tumor preventing their approximation. If, however, the tumor is small and situated above the vocal bands, but slight, if any, subjective symptoms will be noticed. As the growth of a laryngeal tumor increases, dyspnœa increases, and asphyxia may suddenly occur unless prompt relief is at hand. Cough is not usually present unless the growth is of such a character as to vibrate in the breath current and titillate, as it were, the interior of the larynx, when cough and laryngeal spasms may occur. Chronic laryngitis is usually present as the result of laryngeal tumors.

FIG. 107.

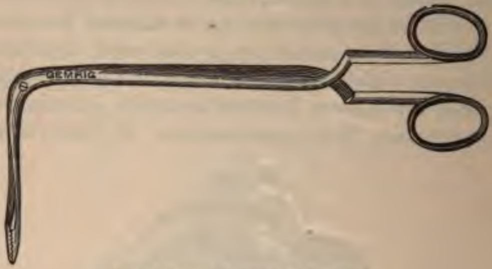


Cancer of the Larynx.

What is the treatment?

Tumors springing from the epiglottis can usually be removed by means of a Jarvis snare with a curved lip, while cysts may be opened with the laryngeal lancet (Fig. 102) and their contents allowed to escape. Papilloma and soft or pedunculated tumors should be removed by means of the laryngeal forceps (Fig. 108), if necessary, picking off piece after piece until the entire tumor has been removed. In every case of tumor of the larynx, the emergencies of the case govern the operative procedures necessary. If the removal of the tumor is very urgent, to prevent suffocation, and the patient's throat is too irritable to permit instrumental interference without danger of a fatal result from induced spasm of the glottis, tracheotomy should of course be performed before the removal of the tumor is attempted. If the growth is malignant, extirpation of the larynx, either in part or as a whole, gives the only hope of bringing about a cure of the affection.

FIG. 108.



MacKenzie's Laryngeal Forceps.

Foreign Bodies in the Larynx.

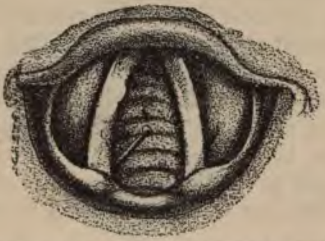
What foreign bodies are found in the larynx?

Smooth substances, such as small pebbles, shoe buttons, seeds of various kinds, etc., are not apt to lodge in the larynx, but are either removed by a fit of coughing or drop into the trachea, where they cannot be removed. Substances with sharp points, like fish bones or pins, often partially imbed themselves in the tissues of the larynx.

What is the treatment?

The foreign body should be removed with the laryngeal forceps when possible. In rare cases, a wound of the interior of the larynx is rapidly followed by œdema of the glottis. Under these circumstances, tracheotomy should be performed before any attempt is made to remove the offending substance.

FIG. 109.



A pin imbedded in the posterior portion of the right vocal cord. (*Seiler.*)

Laryngeal Neuroses.

What varieties of motor paralysis affect the larynx

Paralysis may affect but one laryngeal muscle or pair of muscles; or it may affect several of them at once, and may be either unilateral or bilateral. Paralysis of the larynx may be divided clinically into paralysis of the adductors, paralysis of the abductors, and paralysis of the tensors of the cords.

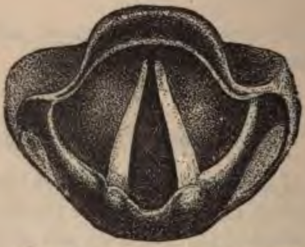
What is its etiology?

The laryngeal muscles receive their nerve supply by means of two branches of the pneumogastric: the superior laryngeal and the recurrent laryngeal. The pneumogastric, at its origin, is a sensory nerve, but receives motor fibres from the spinal accessory, so that it possesses both sensory and motor functions above the point where the superior laryngeal is given off. Paralysis of the laryngeal muscles may be due, like paralysis of other muscles, to (1) disease or injury of the brain involving the cerebral portion of the nerves that supply the larynx; (2) injury or pressure of the nerves below their cerebral portion; (3) an abnormal condition of the muscles themselves, and (4) some systemic dyscrasiæ, like rheumatism or hysteria, because of which the muscles are unable to respond to nervous influence.

Describe adductor paralysis.

Adduction of the vocal cords being performed by means of the lateral crico-arytenoid muscles and the arytenoideus muscle, paralysis of these muscles causes the cords to remain in a state of extreme abduction. This condition is in most instances due to hysteria, rheumatism involving either the muscles or the crico-thyroid joint, or chronic poisoning by lead or arsenic. If bilateral paralysis exists, the vocal cords will be seen in the laryngeal mirror separated to the utmost degree (Fig. 110), and the voice will be completely lost. If paralysis of the arytenoideus muscle alone exists, which, however, is rarely the case, the anterior two-thirds of the vocal bands can be approximated; but a triangular space will be left behind the vocal processes during phonation, through which the breath escapes and renders the voice feeble, and its use in singing and speaking both fatiguing and unsatisfactory. This condition of affairs may occur during the course of either acute or chronic laryngitis from extension of the inflammation to the arytenoideus muscle (Fig. 111).

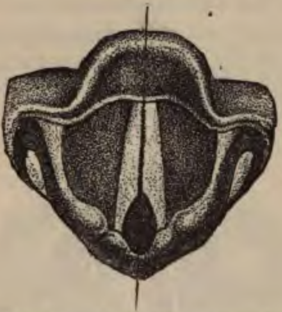
FIG. 110.



Bilateral paralysis of the adductors (crico-arytenoidei latesalis and arytenoideus). Appearance in attempted phonation.

In unilateral adductor paralysis, only one cord is seen in extreme abduction during phonation, and the opposite cord will be observed to pass beyond the median line, so as to approach as near as possible to its motionless companion (Fig. 112). Although aphonia exists, the whispered words are usually perfectly comprehensible.

FIG. 111.

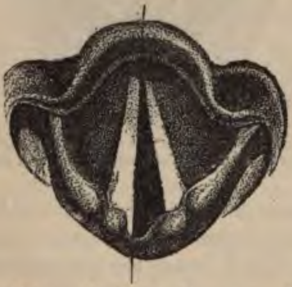


Bilateral paralysis of the arytenoideus.

Describe abductor paralysis.

Abduction of the vocal cords is accomplished solely by means of the crico-arytenoid muscle, and hence the complete paralysis of both of them will prevent separation of the cords, and almost completely prevent the entrance of air into the lungs ; a mere slit posteriorly, which represents the action of the arytenoideus being the extent of

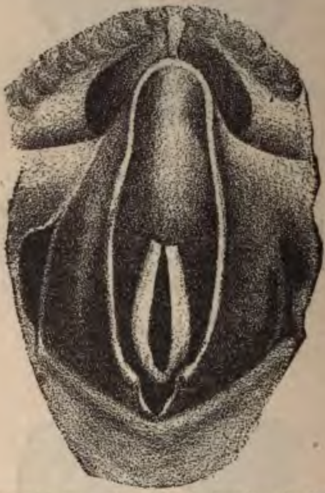
FIG. 112.



Unilateral paralysis of adductor of left cord. Appearance in attempted phonation.

the available breathing space. During expiration, however, the vocal cords are forced apart by the ascending air current impinging upon their under surfaces, which curves upward from the sides of the larynx. The voice is unimpaired in this affection, but where complete paralysis of the abductors exists it may be necessary to perform tracheotomy to prevent suffocation occurring as the result of slight inflammatory swelling of the mucous membrane of the larynx as the result of a cold. Paralysis of the abductors may result from a tumor in the brain involving the origin of both pneumogastrics and spinal accessory nerves. In such cases the abductors of the larynx are first paralyzed, but as the tumor increases in size paralysis of all the muscles of the larynx results, the cords assuming the "cadaveric position" (Fig. 113). Paralysis of both posterior crico-arytenoid muscles may result also by pressure upon the recurrent laryngeal nerves by an aneurism, a goitre, or carcinoma of the œsophagus, or the lesion may be located in the muscles themselves.

FIG. 113.



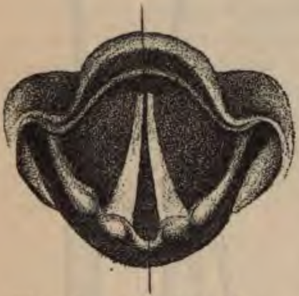
Appearance of the normal larynx after death, showing the "cadaveric position" of the vocal cords. This is also their position in quiet breathing. (*Brown.*)

When unilateral paralysis only is present, the affected cord will be seen to remain always in the median line, even during forced inspiration, but subjective symptoms will be so slight as to hardly attract attention. The voice will be perfect and the breathing space ample, except during violent exercise (Figs. 114, 115).

Describe paralysis of the tensors of the vocal cords.

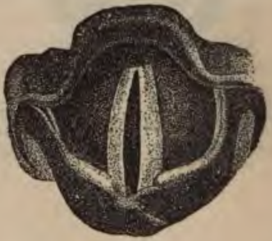
Two forms of paralysis of the tensors of the vocal cords are met with, one due to paralysis of the crico-thyroid muscle, which is rare, and the other one to paralysis of the thyro-arytenoids, which is not uncommon. Paralysis of the former muscle causes the edges of the cords to assume a wavy line, touching each other at irregular intervals during phonation (Fig. 116), while the voice is coarse and remains at always the same pitch. When the thyro-arytenoids are paralyzed, the cords assume a slightly curved appearance when an attempt is made to bring them together during phonation, and a slight space remains between their centres (Fig. 117). The voice is husky, high-pitched and weak, the air escaping through the elliptical space between the cords necessitating great effort on the part of the patient in order to speak.

FIG. 114.



Bilateral paralysis of the abductors (crico-arytenoidei postici). Appearance with deep inspiratory effort. (*Brown.*)

FIG. 115.

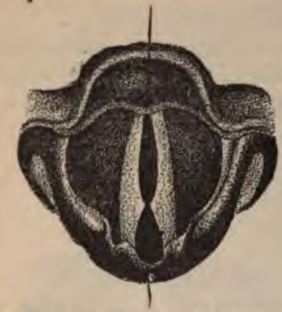


Unilateral paralysis of the left abductor. Appearance in phonation. The affected cord is seen to be in the cadaveric position, while the other is advanced beyond the median line. (*Brown.*)

What is the treatment of paralysis of laryngeal muscles?

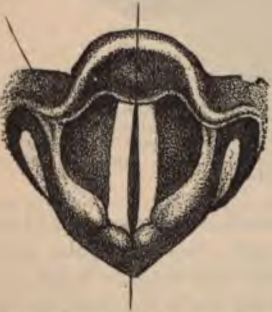
The cause of the paralysis should be carefully sought and treate the success of the measures adopted depending, of course, upon th nature of the primary ailment. In suitable cases strychnia should be administered in gradually increasing doses until the limit o toleration has been reached, and galvanism or faradism used by

FIG. 116.



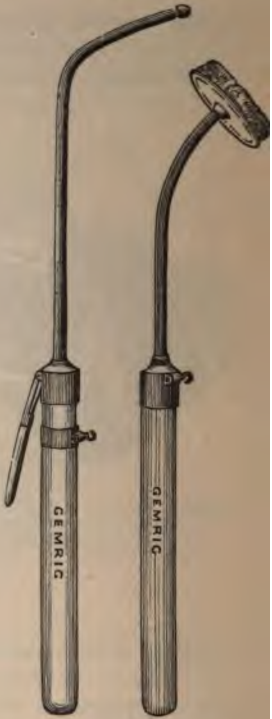
Bilateral paralysis of the thyro-arytenoidei and of the arytenoideus. (*Brown.*)

FIG. 117.



Bilateral paralysis of the sphincter of the glottis (thyro-arytenoidei). (*Brown.*)

FIG. 118.



MacKenzie's Laryngeal Electrode.

means of the laryngeal electrode (Fig. 118) applied within the larynx as near as possible to the affected muscles. An ordinary sponge electrode is held by the patient or an assistant upon the skin over the larynx, while the operator guides the tip of the electrode into the larynx, watching its progress with the laryngoscope—until it is in the desired position. The finger-rest on the top of the handle of the instrument is now depressed, and the current passes. Each application should last but a few seconds, and be repeated three or four times at each sitting, at intervals of one or two minutes. Electricity may be used in this manner every other day, the current used not stronger than is sufficient to secure contraction of the affected muscles. At first the mere introduction of the electrode into the larynx causes retching and gagging, and it may be necessary to apply a ten per cent. solution of cocaine to the interior of the larynx by means of a pledget of cotton wrapped about the end of a probe, and dipped into the solution, in order to anæsthetize the parts sufficiently to admit of free manipulation at the first sitting. After a few trials, however, the parts become more tolerant and applications can be borne, in the majority of instances, without trouble.

FORMULÆ.

1. Sodii bicarbonatis,
Sodii biboratis, ... aa . . . . . ʒj
Acidi carbolici, ... gr. xv
Glycerinæ, ... f℥j
Aquæ, ... q. s. ad f℥iv.
M. SIG.—Add to a quart of water and use as a wash.

This is a modification of the celebrated "Dobell's Solution," and is entirely bland and unirritating to mucous membranes. It may be used either as a spray to cleanse the mucous membranes of the nose, throat and larynx, or may be prescribed as a wash for the patient's use at home. When used as a nose wash by the patient it should be at a temperature of about 100 degrees Fahrenheit.

2. Sodii bicarb., ... ʒviij
Sodii bibor., ... ʒviij
Sodii benzoat.,
Sodii salicylat., ... aa . . . . . . gr. xx
Eucalyptol,
Thymol, ... aa . . . . . . gr. xx
Menthol, ... gr. v
Ol. gaultheriæ, ... gtt. vj
Glycerinæ, ... ℥viiiss
Alcoholis, ... ℥ij
Aquæ, ... ad O xvj.

The above formula was devised by Dr. Carl Seiler for use with the atomizer or as a nose wash for patients to use at home. The wash should be made in a concentrated form and allowed to stand for some days before being diluted with water; otherwise it will be extremely irritating and unfit to use. The solid ingredients have been compressed into tablets, one of which dissolved in four tablespoonfuls of warm water makes a wash very similar in its composition to the above. The tablets are made by several Philadelphia manufacturing pharmacists and are very convenient to prescribe, but different specimens vary greatly in the amount of irritation they cause when dissolved and used as a wash. The practitioner should, therefore, before prescribing such tablets, assure himself that they are manufactured from good materials, are freshly made, and that when dissolved in the requisite amount of water, they make a solution of exactly the specific gravity of blood serum, as otherwise they will be unduly irritating.

3. Listerine,	f℥iii–vj
Aqua,	O ij.

Useful as a disinfectant and irritating wash in atrophic rhinitis.

4. Fluid cosmoline, ("O")

May be used with the atomizer and applied to the nasal mucous membrane as a protective.

5. Antipyrin,	gr. xvj
Aquæ,	f℥j.

A solution of antipyrin of the above strength, when sprayed upon the mucous membrane of the nose, pharynx or larynx, has the power of contracting the capillaries and producing an artificial anæmia, which effect is maintained for three to five hours. The above solution may be used with the atomizer in all acute inflammations of the mucous membrane of the upper respiratory tract. When used after the application of cocaine to the interior of the nose, it will maintain the contractile effect of that drug upon the erectile tissue for several hours. When sprayed upon the nasal mucous membrane without the previous application of cocaine, it gives rise to a smarting sensation, which, however, quickly subsides. Applied as a spray within the larynx by means of an atomizer, it contracts the blood-vessels of the laryngeal mucous membrane and diminishes secretion, cough and expectoration. It is extremely valuable as a remedy in the night cough of laryngitis phthisica, often securing a night's rest for such patients, who may be provided with an ordinary hand atomizer filled with a solution of antipyrin, and instructed to inhale its spray as often as is required to control the cough.

6. Solution of the hydrochlorate of cocaine, 4 %.

The local anæsthesia produced by the application of a four per cent. solution of cocaine, to the nasal mucous membrane, although later in making its appearance, is more profound and enduring than if a stronger solution were employed. The solution of cocaine should not be used with an atomizer for the purpose of producing anæsthesia of the nasal mucous membrane, as it is liable to find its way into the pharynx and produce a most disagreeable sensation, the throat "feeling as if it were full of cotton," or some of the solution might even be swallowed and produce an untoward constitutional effect. When it is desired to produce local anæsthesia of any portion of the interior of the nose for the purpose of operation, a piece of absorbent cotton should be saturated with the cocaine solution and laid in contact with that part of the nose where the anæsthesia is desired, and, after the lapse of a few moments, the sensibility of the parts tested with a probe, and, if anæsthesia has not been produced, the piece of absorbent cotton should be again dipped in the solution of cocaine and replaced within the nose. Anæsthesia of the larynx should be produced by throwing a fine spray of a 10 per cent. cocaine solution upon the laryngeal mucous membrane, and repeating the procedure after an interval of two or three minutes.

Anæsthesia of the larynx, produced by the application of a solution of cocaine, appears quickly after the application and lasts only a short time.

7.	Iodini,	gr. viij
	Potassii iodidi,	gr. xxiv
	Glycerinæ,	f℥ss.
8.	Iodini,	gr. xij
	Potassii iodidi,	gr. xxxvj
	Glycerinæ,	f℥ss.
9.	Iodini,	gr. xvj
	Potassii iodidi,	gr. xlviij
	Glycerinæ,	f℥ss.

The last three formulæ may be used in the treatment of chronic rhinitis and hypertrophic rhinitis. Formula 7 should be used as long as the application is followed by a slight smarting sensation; but when this no longer occurs, Formula 8 or 9 may be substituted, with better results to the patient.

10.	Tinctura ferri chloridi,	
	Glycerinæ, . . . āā	f℥ss.

Useful as an application to erosions over varicose vessels in chronic nose-bleed.

11.	Argenti nitratis,	ʒj–ij
	Aquæ,	f℥j.

Useful as an application to the pharynx or tonsils in acute pharyngitis or tonsillitis. When applied sufficiently early will often abort the disease.

12.	Argenti nitratis,	gr. iij
	Amyli,	ʒ iiss.

13.	Argenti nitratis,	gr. vj
	Amyli,	ʒ iiss.

14.	Argenti nitratis,	gr. ix
	Amyli,	ʒ iiss.

15.	Argenti nitratis,	gr. xij
	Amyli,	ʒ iiss.

Formulæ 12, 13, 14, and 15 are useful in the treatment of atropic rhinitis. Formula 12 should be applied with the powder blower to nasal mucous membrane as long as its use is followed by a moderate amount of smarting and increased nasal discharge. When this ceases to occur, Formulæ 13, 14, or 15 may be used in turn until this desired result is attained.

16.	Zinci sulphatis, Sacchari lactis, ... aa	ʒ ij
	Acaciæ,	gr. x.

Useful as an application to the laryngeal mucous membrane in acute and chronic laryngitis.

17.	Iodiformis,	gr. xxx
	Acidi tannici,	gr. xx
	Amyli,	gr. xxx.

Useful as an application in syphilitic laryngitis.

18.	Bismuth. subnitratis,	ʒ ij
	Acaciæ,	ʒ ij
	Iodoformis,	ʒ ss
	Morphiæ sulphatis,	gr. xx
	Acidi tannici,	gr. xxx.

Useful as an application to the laryngeal mucous membrane in tubercular and syphilitic laryngitis, and in the earlier stages of acute laryngitis, or in any laryngeal affection characterized by irritability and pain.

19. Bismuth. subnitratis, ... ʒij
Sodii bicarb., ... gr. xv
Acaciæ, ... ʒij
Morphiæ sulphatis, ... gr. xx.

Useful as a snuff in acute coryza. The gum acacia coming into contact with moisture forms a paste, which closely adheres to the nasal mucous membrane, and is rendered astringent and anodyne by the presence of the subnitrate of bismuth and morphia. The bicarbonate of sodium is added to the formula to prevent acid fermentation.

20. Tinctura gentianæ comp., ... fʒij
Elixir cinchonæ, ... f℥j
Syrupi limonis, ... f℥ss
Spiritus frumenti, ... q. s. ad . . . . f℥viij. M.
Sig.—Dose, one or two tablespoonfuls.

A useful formula where it is desired to administer an alcoholic stimulant, but where it is undesirable from any cause to advise the use of whiskey pure and simple.

21. Hydrargyri bichloridi, ... gr. j
Potassii iodidi, ... ʒij
Aquæ, ... f℥iij. M.
Sig.—One to three teaspoonfuls after meals.

The above formula is sometimes called "1, 2, 3, mixture;" and may be ordered where it is desired to administer the mixed treatment in syphilis.

22. Pil. hydrarg. protiodidi, ... gr. $\frac{1}{4}$.
Sig.—One pill may be taken three or four times a day; with a sufficient quantity of opium to prevent diarrhœa.

Useful in the treatment of primary and secondary syphilis.

23. Pil. hydrarg. biniodidi, ... gr. $\frac{1}{16}$–$\frac{1}{8}$.
Sig.—One pill may be taken after each meal.

Useful in the treatment of the later stages of syphilis.

24. Cocaine hydrochloridis, ... gr. ss.
Gelatin, q. s. fiant troch. No. 1.

The above troche, taken before each meal, will often enable a patient with phthisical laryngitis or cancer of the larynx, to swallow a sufficient quantity of nourishment, when otherwise it would be impossible, on account of the pain.

25.	Potassii bromidi,		℥ss	
	Potassii cyanidi,		gr. iss	
	Ext. prunus virginianæ,		f℥ss	
	Ext. grindelia robusta,		fʒiij	
	Muc. acaciæ,			
	Aquæ dest.,	aa q.s.	f℥iv.	M.

Sig.—Teaspoonful in water four times a day.

Useful as a cough mixture.

26.	Tincturæ ferri chloridi,		fʒij	
	Potassii bromidi,		ʒij	
	Potassii chloratis,		ʒiij	
	Ext. glycyrrhiza,		ʒj	
	Aquæ,	ad	f℥vj.	M.

Sig.—A teaspoonful in water every two hours, gargle and swallow.

Useful in acute pharyngitis and tonsillitis.

27.	Potassii chloratis,			
	Potassii bromidi,			
	Ext. glycyrrhizæ,	aa	gr. iij	
	Tr. ferri chloridi,		♏iss.	M.
	Fiant troch. No. 1.			

Sig.—One every two or three hours.

Useful in acute pharyngitis, tonsillitis and laryngitis.

28. Tr. guaiac. ammoniatæ, ... f℥j.

Sig.—One-half teaspoonful in milk every three or four hours, gargle and swallow.

Useful in acute pharyngitis or tonsillitis of rheumatic origin.

29.	Potassii bromidi,		℥ss	
	Potassii iodidi,		ʒiss	
	Ext. glycyrrhizæ,		ʒiss	
	Aquæ, q. s. ad.,		f℥iv.	M.

Sig.—A teaspoonful three or four times a day.

Useful in pharyngitis sicca, to increase the pharyngeal secretions and relieve the feeling of dryness in the throat.

30.	Acidi tannici,			
	Acidi gallici,	aa	gr. x.	M.

Sig.—Add to a tumblerful of water, and slowly stir the mixture.

Useful in controlling oozing of blood from the wound after amputation of the tonsil.

31. Pil. atropia sulphatis, ... gr. $\frac{1}{200}$.
SIG.—One every three or four hours.

Useful in controlling excessive nasal secretion in coryza and hay fever.

32. Hydrarg. bichlor., ... gr. $\frac{1}{4}$
Acidi arseniosi, ... gr. $\frac{1}{3}$
Ferri pyrophos., ... gr. vj
Quinia sulph., ... gr. xv. M.
Fiant pil. No. xxiv.
SIG.—One after meals.

Useful as a tonic pill in catarrh of the nose and throat, with a debilitated condition of the system.

33. Hydrarg. bichlor., ... gr. iij
Aquæ destil., ... f℥j. M.
SIG.—Corrosive sublimate solution for hypodermic use.

♏ x = gr. $\frac{1}{16}$. ♏ xiij = gr. $\frac{1}{12}$. ♏ xv = gr. $\frac{1}{10}$ ♏ xx = gr. $\frac{1}{8}$.

Useful in syphilitic affections of the nose and throat where it is advisable to get the patient under the influence of mercury as speedily as possible. The injections may be made as often as once a day, deep into the cellular tissue of the back. The injection causes a moderate amount of pain, which continues for about an hour, and the place where the injection was made remains a little sensitive to the touch for twenty to forty-eight hours; abscess, however, does not occur—where the proportion of corrosive sublimate is not greater than in the above formula.

34. Tr. benzoin comp.
SIG.—Add half a teaspoonful to the inhaler (Fig. 74) one-half full of hot water. Use the inhaler four or five times a day.

Useful in most forms of laryngeal inflammation. To the above formula, when requisite, an expectorant—ammonia muriat., fluid extract of senega or ipecac—may be added. When it is desired to diminish expectoration, and at the same time produce a sedative effect upon the laryngeal mucous membrane, fluid extract of belladonna or hyoscyamus in combination with the compound tincture of benzoin will yield satisfactory results.

INDEX TO PART I.

ABDUCENS paralysis, 60
Aberration, 48
Abscess, lacrymal, 79
  of cornea, 94
  orbital, 139
Abscission, 98
Absolute squint, 52
Absorption of cataract, 124
Accommodation, 27, 29, 30
  loss of, 59
Acuteness of vision, 26, 135
Adherent leucoma, 97
Advancement operation, 57
Albinism, 107, 114
Albuminuric retinitis, 131
Alcohol, 141
  amblyopia, 137
Alternating squint, 53
Alum, 143
Amaurosis, 62
Amblyopia, 54, 62, 137
Ametropia, 28
Amyloid degeneration, 87
Aniridia, 107
Anisometropia (*unequal refraction in the two eyes*)
Ankyloblepharon, 73
Anomalies of refraction, 28
Anterior synechiæ, 92
  staphyloma, 93
Antiseptics, 141
Aphakia, 128
Applications to the lids, 81
Aqueous humor, 17
Arcus senilis, 98
Argyll-Robertson pupil, 108
Arterial pulsation, 129
Artificial eye, 116
  pupil, 105
Asthenopia (*weakness of the eyes, causing pain when used*)
Astigmatism, 43-49
Astringents, 142
Atrophy of the choroid, 110, 111
  optic nerve, 137
Atropine, 41, 144

BANDAGES, 81, 89, 92, 126
Band-like corneal opacity, 97
Basedow's disease, 140
Binocular vision, 50
  field, 61
"Black eye," 76
Blepharitis, 70
Blepharophimosis, 73
Blepharospasm, 72
Blindness of one eye, 63
Blood-vessels in the vitreous, 118
Bony tumor of the orbit, 140
Borax, 145
Boric acid, 145
Bowman's probes, 78
Brain tumor, 135
Bright's disease, 131
Bruise of the eyeball, 99, 106, 114

CANALICULUS, slitting the, 78
Canthoplasty, 73
Carcinoma, 140
Caries of the orbit, 139
Cataract, 119-127
Catarrhal conjunctivitis, 81
Catoptric examination, 67
Cellulitis of orbit, 139
Central choroiditis, 111
  scotoma, 137
Cerebral disease, 135
Chalazion, 71
Chemosis, 80
Choked disk, 135

Cholesterin in the vitreous, 118
Choroid, 109-114
Choroiditis, 109
Chromatopsia, 65
Chronic conjunctivitis, 82
Ciliary body, 109
    muscle, 29
Circum-corneal redness, 90, 100, 129
Cocaine, 143
Coloboma, 106, 114, 127
Color-blindness, 63, 65
    perception, 64
    fields, 65
Colored vision, 65
Concave lenses, 22, 42
Concomitant squint, 51
Congenital anomalies, 106, 107, 127
    cataract, 121
Conical cornea, 98
Conjunctival discharge, 81
    diseases, 79–90
Conjunctivitis, 80–85
Conus, 111
Convergent rays, 27
    squint, 52
Copper sulphate, 142
Corectopia, 107
Cornea, 17, 67, 68, 90
    haziness of, 128
    inspection of, 66, 67
Corneal inflammations, 88–96, 128
Cortical cataract, 120
Croupous conjunctivitis, 84
Crystalline lens, 17, 29, 30, 68, 119
Cupping of the disk, 34, 129
Cyclitis, 109
Cylindrical lenses, 43, 48
Cysts of iris, 106
    orbit, 140

DACRYO-CYSTITIS, 77
Daturin, 41, 144
Dermoid tumors, 87
Detachment of the retina, 113, 134
Deviating eye, 40
Diabetic cataract, 121
Diagnosis, methods of, 61–69
Dilatation of the pupil, 59
Dioptre, 24
Dioptric lenses, 23
    media, 17
    surfaces, 17, 25
Diphtheritic conjunctivitis, 84
Diplopia, 50, 52, 59
Discission of cataract, 124
Dislocation of lens, 127
Disseminated choroiditis, 111
Divergent rays, 27
    squint, 52
Double sight, 50, 52, 59
Drugs, 141
Duboisin, 41, 144
Dynamic squint, 57

ECCHYMOSIS of the conjunctiva, 87
    lids, 76
Ectropion, 75
Electro magnet, 119
Elevator, lid, 67
Embolism of the retinal artery, 133
Emmetropia, 28, 38
Entropion, 74
Enucleation of the eye, 113, 116
Epicanthus, 75
Epiphora, 76
Epithelioma, 87
Errors of refraction, 29
Esophoria, 58
Eversion of punctum, 77
    of upper lid, 66
Evisceration of the eye, 117
Excision of the eye, 116
Exclusion of the pupil, 101
Exophoria, 58
Exophthalmic goitre, 140
Exophthalmos, 140
Exostoses of the orbit, 140
Extraction of cataract, 125
Eyelids, 70–76
Eye-strain, 47, 49

FACIAL nerve paralysis, 73
False image, 50
Far-sight, 28, 39
Feigned blindness, 63
Field of fixation, 61
    vision, 61, 64
Fissure of the lids, 89
Fistula, lacrymal, 79
Fixation point, 49
Fixing the eye, 49
Flap extraction, 125
Flashes of light, 109
Fluid cataract, 125
Focal distance, 22

Focus, 21, 44
Foreign body in cornea, 98
    vitreous, 119
    orbit, 139
Formulæ, 141
Fovea centralis, 49
Fracture of orbit, 76
Frontal sinus distention, 140
Functional diseases, 61
Fundus of the eye, 33

GLAUCOMA, 41, 128, 129
Glioma of the retina, 134
Glycerine, 142
Goitre, exophthalmic, 140
Gonorrhœal ophthalmia, 83
Granular conjunctivitis, 84
Granuloma of iris, 106
Graves' disease, 140
Gumma of iris, 102

HARD cataract, 149
Headache, 49
Hemianopic pupil, 108
Hemianopsia, 62
Hemorrhage, choroidal, 111
    retinal, 131, 135
    vitreous, 118
Herpes zoster, 91
Heterochromia, 107
Heterophoria, 57
Holmgren test, 64
Homatropin, 41, 144
Homonymous diplopia, 52
    hemianopsia, 63
Hordeolum, 70
Hyalitis (inflammation of the vitreous)
Hyaloid artery, 118
Hyoscyamin, 41, 144
Hyperemia, 79, 83, 90, 100
Hypermetropia, } 28, 38, 39, 52
Hyperopia, }
Hyperphoria, 58
Hypopyon, 94
Hysteria, 63, 72

INCH system of lenses, 23
Incipient cataract, 124
Index of refraction, 17
Indirect examination, 36
Inferior oblique muscle, 59
Injuries of the lens, 127
    lids, 76
    orbit, 139
Inspection of the eye, 65
Intermittent squint, 54
Interstitial keratitis, 94
Intraocular tension, 128
Iridectomy, 104, 105, 130
Irideremia, 107
Iridodialysis, 106
Iridotomy, 105
Iritis, 100–105
Irregular astigmatism, 48
Ivory exostosis, 140

JEQUIRITY, 96

KERATITIS, 91-96
    punctata, 101
Kerato-globus, 98
Keratoscopy, see Retinoscopy.

LACRYMAL abscess, 79
    apparatus, 75
    obstruction, 78
    stricture, 78
Lagophthalmos, 73
Lashes, 66
Latent squint, 57
Lens, crystalline, 17, 119
Lenses, 19–25, 43
Leucoma, 96
Leukemic retinitis, 132
Lid retractor, 67
Lids, diseases of, 70–76
    eversion of, 66
    inspection of, 66
Lupus, 87

MACULA, corneal, 96
Macular choroiditis, 111
Magnet extraction, 119
Malarial ulcer of cornea, 92
Marginal blepharitis, 70
Meibomian concretions, 87
    cysts, 71
Meningitis, 135
Mercuric salts, 141

Meridians, 44
Metric system, 23
Milium, 72
Modified linear extraction, 126
Molluscum, 72
Monocular squint, 53
Movements, ocular, 49
    of the pupil, 107
Muscular insufficiencies, 57
Mydriasis, 109
Mydriatics, 41, 144
    for iritis, 102
Myopia, 28, 38, 41, 52, 104, 134
Myopic crescent, 111
Myosis, 109
Myotics, 145

NEAR point, 29
    sighted, 41
Nebula, 96
Neuralgia, 129
Neuro-paralytic ulcer, 91
New growths, 71
Nitrate of silver, 142
Nuclear cataract, 120
Nystagmus, 60

OBSTRUCTION, lacrymal, 78
Occlusion of pupil, 101, 104
Ocular palsies, 59
Oculo-motor paralysis, 59, 107
Onyx, 94
Opacities of the cornea, 97
Ophthalmia, see *blepharitis, conjunctivitis, keratitis, iritis, scleritis, glaucoma and sympathetic*
Ophthalmic zoster, 91
Ophthalmitis, sympathetic, 114
Ophthalmometer, 67
Ophthalmoplegia externa, 60
Ophthalmoscopes, 31, 47
Ophthalmoscopic appearances, 35, 110, 122
Optic atrophy, 137
    disk, 34, 135
    neuritis, 135
Optical centre, 20
Orbit, diseases of, 139
Orbital, cellulitis, 139
Orthophoria, 57
Oscillation of the eyes, 60

PAIN, 80, 100, 121, 128
Pannus, 85, 96
Panophthalmitis, 113
Papillitis, 135
Parallel rays, 27
Paralysis, external muscles, 59
Paralytic squint, 51, 58, 60
Parenchymatous iritis, 102
Partial cataract, 124
Perforating ulcer, 92
Pericorneal zone, 90
Periodic squint, 54
Persistent nerve-sheath, 134
Phlyctenular ophthalmia, 87
Pilocarpin, 145
Pinguecula, 87
Placebo, 145
Placido's disk, 68
Plane mirror, 37
Plastic choroiditis, 110, 118, 119
    iritis, 102
Polycoria, 107
Polypus, 87
Posterior staphyloma, 111
    synechia, 101, 104
Poulticing the eye, 81, 89, 92
Presbyopia, 30
Prisms, 19, 58
Probing nasal duct, 78
Pseudo-glioma, 119
Pterygium, 86
Ptosis, 72
Pulsating tumor of the orbit, 140
Punctate keratitis, 101
Punctum, everted, 77
    slitting, 77
Pupil, 31, 107
    dilatation of, 59
    in iritis, 100
    reactions of the, 107
Pupillary membrane, persistent, 106
Purulent choroiditis, 112
    conjunctivitis, 83
    iritis, 102

QUININE amblyopia, 137

RECTI muscles, palsies of, 59
Redness of the globe, 80, 109, 129
Reflex neuroses, 49
Refracting angle, 19

Refraction, 17
    measured by the ophthalmoscope, 31
    of the eye, 25, 27
Refractive index, 17
Relative squint, 52
Retinal diseases, 131
    vessels, 34
Retinitis, 131
    albuminuric, 131
    pigmentosa, 133
Retinoscopy, 37
Retro-bulbar neuritis, 137
Reversal, point of, 37
Ripeness of cataract, 123
Rupture of choroid, 114
    eyeball, 100
    iris, 106

SARCOMA, 106, 113, 140
Scleritis, 99
Sclerotic, 99
Sclerotico-choroiditis, 111
Sclerotomy, 130
Scoop extraction, 126
Scotoma, 61, 109
Second sight, 120
Secondary cataract, 127
Senile changes in the eye, 107, 119, 120
Serous iritis, 102
Shadow test, 37, 47
Short sight, 28, 38. 41
Sight, acuteness, 26
Silver nitrate, 142
Simple extraction, 125
Size of pupil, 107
Skiascopy, 37
Slitting the canaliculus, 78
Sodium chloride, 145
Soft cataract, 121
Spherical aberration, 48
Squint or strabismus, 49
Staphyloma, 97, 112
Stillicidium lacrymarum, 76
Strabismus instruments, 54
Strength of a lens, 25
Stricture of nasal duct, 78
Suction of cataract, 358
Sulphate of copper, 142
Suppurating ulcer, 93
Symblepharon, 142
Sympathetic inflammation, 114
    irritation, 114
Synchysis, 118
Synechial, 96, 101
Syphilis, 87, 118, 133
Syphilitic iritis, 102
    choroiditis, 112

TABLES, 24, 30
Tannin, 142
Tarsorraphy, 73
Tenotomy, 55, 58
Tension of globe, 69, 113, 128
Tobacco amblyopia, 137
Toxic amblyopia, 137
Trachoma, 84
Transplantation of cornea, 97
Trial set, 24
Tubercle of choroid, 114
    iris, 106
Tumors, 140

UNILATERAL squint, 53

VERNAL conjunctivitis, 82
Vertical diplopia, 53
Vertical squint, 53
Virtual focus, 22
Vision, acuteness of, 20
Visual axis, 49
Vitreous humor, 17, 118

WOUNDS of cornea, 99
    eyelids, 76

XANTHELASMA palpebrarum, 72
Xerosis, 87

ZINC sulphate, 142
Zoster, 91.

INDEX TO PART II.

ABDUCTOR paralysis of vocal cords, 248
Ablation of adenoid tissue of the pharynx, 232
    anterior and middle hypertrophies, 183
    ecchondrosis of septum, 193
    posterior hypertrophies, 189
Abortive treatment of coryza, 179
Abscess of the septum, 215
    symptoms, 215
    treatment, 215
Accessory instruments, 169
Acid, carbolic, 254
    chromic, 185
    nitrate of mercury, 212, 221, 242
    nitric, 185
    tannic, 257
Acne as the result of catarrh, 201
Aconite, 179
Acute laryngitis, 234
        œdematous, 238
        simple, 234
        symptoms, 234
        traumatic, 235
        treatment, 235
    pharyngitis, 212
        symptoms, 217
        traumatic, 217
        treatment, 217
    rhinitis, 177
        ætiology, 178
        pathology, 178
        symptoms, 178
        treatment, 179
    sore throat, 217
    tonsillitis, 217, 224
        ætiology, 224
Acute tonsillitis, pathology, 224
        treatment, 226
Adductor paralysis of vocal cords, 248
Adenoid tissue of the pharynx, 230
    ablation of, 232
Adenoma, 223
Adhesion of anterior pillars to tonsils, 227
Adjustable gas bracket, 154
Air compressors, Burgess', 171
Air prepared for respiration by nasal cavities, 174
Alæ of nose, 163
Alcohol, 257
Allen's nasal speculæ, 164, 165
    septum knife, 214
Alligator forceps, 195
Alteratives, 181
Amputation of tonsil, 228
        uvula, 229
Amygdalitis, 225
Anæmia of the larynx, 233
    significance of, 233
Anæsthesia of the larynx, 256
        local, by cocaine, 256
Aneurism, 223
Angina catarrhalis, 217
    faucium, 225
    tonsillaris, 225
Angular scissors, 193
Anodynes, 209, 244, 257
Anterior hypertrophies, 182, 189
    pathology of, 182
    treatment, 183
    nares, 163
    rhinoscopy, 163, 166
Aphonia, 234, 239, 245
        hysterical, 248
        paralytic, 248
        prognosis, 252
        treatment of, 252

Applications, topical method of making, 181
Applicator, cotton, 169
Artificial finger nail, 232
Ary-epiglottic folds, 162
Arytenoid cartilages, 161
  muscle, 249
    pyriform swelling of, in phthisis, 244
Asphyxia, from œdema of larynx, 239
  spasm accompanying neoplasms, 245
Asthma dependent upon nasal disease, 177, 201
  hay, 204
Astringents, 235, 238
Atomizers, Burgess', 169, 170
  Sass', 169
  disadvantages of metal and rubber, 170
Atrophic nasal catarrh, 196
    ætiology of, 196
    prognosis of, 199
    symptoms of, 197
    treatment of, 198
  pharyngitis, 217
    ætiology of, 217
    symptoms of, 217
    treatment of, 217
  rhinitis, 196
Atropia, 205, 259
Auto-laryngoscopy, 160
Autumnal catarrh, 204
Avery, 150

BABBINGTON, 150
Bands, ventricular, 161
  vocal, 161
Battery, galvano-cautery, 188
  storage, 188
Baumes, 150
Bellocq's canula, 207
Bennati, 150
Benzoin, tincture of, 236, 238, 241.
Bifurcation of the trachea, 161
Bilateral paralysis, 248, 251
Bleeding of nose, 195, 205
Bony obstruction of nose, 191
    treatment of, 192
Bosworth, 191
  nasal dilator, 163, 164
Bottle inhaler, 170
Bougies, 243
Bozzini, 149, 150
Breathing, laryngeal image in, 162
Bromide of potash, 258, 259
Bronchia, openings into, 161
Browne, L., 155, 158, 159, 162, 242, 248, 249, 250, 251, 252
  laryngeal dilator, 242
Brush, 169
Bulbs, olfactory, 173
Burgess' air compressor, 171
  atomizer, 170

CAGNIARD de Latour, 150
Cancer of the larynx, 245
Cannula, Bellocq's, 207.
Carbolic acid, 254
Carbonic acid, 240
Carcinoma, laryngeal, 245
  nasal, 209
  pharyngeal, 223
Caries of nasal bones, 210
Cartilage knife, 193
Cartilages, arytenoid, 161
  cricoid, 161
  of Santorini, 162
  of Wrisberg, 162
  thyroid, 161
Catarrhal conjunctivitis, 200
  inflammation, 174
  ulcers, 197
Catarrh, atrophic, 196
  autumnal, 204
  dry, 196
  chronic nasal, 179
  hypertrophic, 182
  syphilitic, 210
  scrofulous, 196
Catching cold, 173
  modus operandi, 176
Catheter, Eustachian, 207
Cause of atrophic catarrh, 196
  chronic laryngitis, 230
    pharyngitis, 218
    follicular pharyngitis, 218.

- Cause of chronic granular pharyngitis, 218
  - cicatricial stenosis of larynx, 241
  - coryza, 176
  - elongated uvula, 229
  - hay cold, 204
  - hypertrophic catarrh, 182
  - paralysis of vocal cords, 247
    - the palate, 201
  - tumors of the nasal cavities, 208
    - pharynx, 225
- Caustic, lunar, 242
- Caustics, 185
- Cautery, galvano-, 186
- Cavernous tissue of turbinated bones, 174
- Chancre, 210, 220
- Cavity of larynx, 161
- Chink of the glottis, 161
- Chlorate of potash, 258
- Chloroform, 216
- Chromic acid, 185
- Chronic angina, 218
  - laryngitis, 236
    - ætiology, 236
    - symptoms, 237
    - treatment, 238
  - nasal catarrh, 179, 200
  - pharyngitis, 218
  - simple catarrh, 179
  - syphilitic laryngitis, 241
    - prognosis, 242
    - symptoms, 241
    - treatment, 241
  - syphilitic pharyngitis, 220
    - symptoms, 220
    - treatment, 221
  - tonsillitis, 227
- Cicatrization of vocal cords, 242
  - treatment, 242
- Classification of laryngeal tumors, 245
- Cleansing of mucous membrane, 180
  - importance of, 180
  - in atrophic catarrh, 198
- Cleavage of middle turbinated body, 201
- Clergyman's sore throat, 218
- Cocaine, 185, 193, 205
- Cod-liver oil, 244
- Cohen's tongue depressor, 160
- Commissure, inter-arytenoid, 162
- Conjunctivitis from nasal catarrh, 200
- Constrictor of glottis, 252
- Copper, sulphate of, 230
- Cords, vocal, 161
- Coryza, acute, 177, 178
  - causes, 176
  - pathology, 176
  - symptoms, 178
  - treatment, 178
  - syphilitic, 210
  - vaso-motor, 177
  - vaso-motoria periodica, 204
  - ætiology, 204
  - symptoms, 204
  - treatment, 204
  - prognosis, 205
- Cosmoline, 181
- Cotton applicator, 169
- Cough, 221
- Cow cold, 204
- Crico-arytenoid, 251
- Crico-arytenoideus lateralis, 248
  - muscle, 251
- Cricoid cartilage, 161
- Croupous inflammation, 174
- Curette, nasal, 203
- Cylinders of absorbent cotton, 198
- Cynanche tonsillaris, 225
- Cystic polypi, 208
    - treatment, 208
  - tumors, 223
- Czermak, 151

- DEVIATION of septum, 212
  - ætiology, 212
  - pathology, 213
  - treatment, 213
- Dilators, nasal, 163
- Diphtheritic inflammation, 174
- Diseases of the nasal cavities, 177
  - septum, 212
  - pharynx, 216
  - larynx, 233
- Dobell's solution, 254
- Douche, nasal, 180
- Dry catarrh, 196
- Dysphagia, 217, 239, 244
- Dyspnœa, 234

- ECCHONDROMA, 223
- Ecchondrosis of septum, 191
  - ablation, 192
  - ætiology, 192
  - symptoms, 192
- Eczema of alæ and lip, 185.
- Electricity, faradic, 252
  - galvanic, 252
  - in aphonia, 252
- Electric light, 153
  - laryngoscope, 154
- Electrode, laryngeal, 252
- Elongated uvula, 229
  - cause and treatment, 229
- Epiglottis, 162
  - cushion of, 161
  - management of, 160
  - pendant, 159
  - pendulous, obstructing
  - turban-like swelling in phthisis, 244
  - view in laryngoscopy, 161
- Epiglottis-forceps, 160
- Epithelioma, 245
- Epithelium of nasal cavities, erosion, 174
- Erectile tissue of nasal cavities, 182
- Erosion of the inter-arytenoid space, 237
- Ether, 206
- Ethmoiditis, necrosing, 200
  - ætiology, 200
  - pathology, 200
  - symptoms, 200
  - prognosis, 203
  - treatment, 203
- Eustachian catheter, 207
  - tubes, 169, 183
- Examination of patient, 172
- Exostosis of septum, 191
  - treatment, 192
- Expectoration, 197, 234, 238

- FARADIC electricity, 252
- Farnham, alligator forceps, 195
- Fauces, irritability of, 160
- Fibrous polypi, 207
- Finger nail, artificial, 232
- Fold, glosso-epiglottic, 162
- Fold, ary-epiglottic, 162
- Follicular pharyngitis, 218
- Forceps, epiglottic, 160
  - laryngeal, 246
  - Lowenburg's post-nasal, 232
  - Seiler's universal, 224
- Foreign bodies, imaginary, 224
  - in the larynx, 246
    - nose, 216
    - pharynx, 224
  - instruments for removal of, 216, 224
- Fossæ, glosso-epiglottic, 162
- Frog face, 207
- Frontal headache, 183
  - sinuses, 183
    - obstructed in catarrh, 182

- GAGGING, how avoided, 157
- Galvanic electricity, 185
- Galvano-cautery knife, 186
  - application of, to anterior and middle hypertrophies, 185, 188
    - batteries, 188
- Garcia, 150
- Gargles, 258
- Gas bracket, 154
- Gaslight, 152, 162
- Gibson's storage battery, 188
- Glands, mucous, of nasal cavity, 173
- Glandular tumors, 230
- Gleason's dilator, 164
- Glosso-epiglottic fold, 162
- Glottis, 161
  - constrictor of, 252
  - œdema of, 238, 247
  - spasm of, 172, 234
- Granular pharyngitis, 218
- Grindelia robusta, 258
- Guillotine, 224
- Gum acacia, 257
- Gummata, 210, 220, 241

- HÆMATOMA of septum, 214
  - prognosis, 215
  - treatment, 215
- Hæmoptysis, simulated, 206
- Hay asthma, 204
  - cold, 204
  - coryza, 204

Hay fever, 204
  ætiology, 204
  hypersensitive areas, 204
  prognosis, 205
  symptoms, 204
  treatment, 205
Hayes' inhaler, 171
Headache, frontal, 183
Head reflector, 152
  rest, 156
Hemorrhage, nasal, 205
History of laryngology, 149
Hoarseness, 234, 236, 241
Horse cold, 204
Hyperæmia of the larynx, 233
  significance, 233
  ætiology, 233
Hyperplasia of vocal cords, 233
Hypersensitive areas in hay fever, 204
Hypertrophic rhinitis, 182, 196
  ætiology, 182
  surgical treatment, 183, 196
  symptoms, 182
  treatment, 183
Hypertrophied turbinated bone, 182, 189, 197, 200
  treatment, 186
Hypertrophies, 182, 189, 199, 200
  pathology, 182
Hypertrophy of tonsils, 227
  an obstacle to laryngoscopy, 159
  symptoms, 227
  treatment, 227
  pharyngeal tonsils, 230
  symptoms, 231
  treatment, 231
  anterior nasal, 182
  pathology, 182
  posterior nasal, 189
Hysterical aphonia, 248

ILLUMINATION, 152
  by artificial light, 152
  by sunlight, 152
  management, 153
Image of larynx, 155
  posterior nares, 168
Imaginary foreign bodies, 224
Inferior meatus, 166
  turbinated bone, 166
Inflammation, catarrhal, 174
  croupous, 174
  diphtheritic, 174
  of mucous membrane, 174
Infra-glottic laryngoscopy, 161
Infundibulum, 183
Inhalation, 170
  expectorants, 260
  of benzoin, 236, 241
Inhaler, 170
  Hayes', 171
Inspissated secretion, how to remove, 198
Instruments accessory to laryngoscopy, 169
Insufflations, 172
Insufflators, 171, 172
Inter-arytenoid commissure, 162
  space, 161
  ulcerations, 237
Introduction of laryngeal mirror, 156
  rhinoscopic mirror, 166
Inversion of laryngeal image, 155
Iodide of potassium, 211, 259
Iodine, 181, 256
  method of applying to nasopharynx, 218
  solutions, 256
Iodoformis, 257
Iron styptics, use of in nose, 206, 256
Irritability of fauces, 159

JARVIS' laryngoscopic mirror, 154
  snare, 189, 228
  transfixing needles, 184

KNIVES, laryngeal, 224, 242

LAMPLIGHT, 152
  Lamp, Tobold's, 152
Lancet, laryngeal, 240
Laryngeal angioma, 245
  bougies, 243
  brush, 169
  cancer, 245
  carcinoma, 245
  cyst, 245
  dilator, 242

Laryngeal electrode, 252
    mode of application, 252
  fibroma, 245
  forceps, 246
  guillotine, 224
  image, 155, 161
    how brought into view, 157
      in breathing, 162
      in vocalization, 162
    inversion of, 155
  knives, 224, 242
  lancet, 240
  mirror, 149, 151
    introduction, 156
    management, 157
    testing temperature of, 158
    warming of, 158
  myxoma, 245
  neuroses, 247
    ætiology, 247
  papilloma, 245
  sarcoma, 245
  sound, 169
  spasm, 172
  tumors, classification of, 245
    symptoms, 245
    treatment, 245
  ulcers, 241, 244
Laryngitis, acute, 234
  chronic, 236
  phthisica, 243
    symptoms, 243
    treatment, 244
  subacute, 236
  syphilitic, 241
  traumatic, acute, 234
    œdematous, 238
    sicca, 238
Laryngoscope, 149
  description, 149
  history, 149
  electric, 154
Laryngoscopy, 154, 161
  auto-, 160
  infra-glottic, 161
  instruments accessory to, 169.
  obstacles, 167
  optical principles of, 155
Larynx, 161
  anæsthesia of, 243, 255
  applications to, 169, 236, 237, 238, 257
  foreign bodies in, 246
  œdema of, 238
  scarification, 249
  spasm, 172
  stenosis, 242
  tubercles in, 243
Latour, Cagniard de, 150
Law of reflection, 155
Leaden mallet, 194
Ledge on nasal septum, 182, 191
  treatment, 191
Levret, 149
Light, artificial, 152
  concentrators, 152
  direct, 152
  electric, 153
  position of, 153
  reflected, 152
  source of, 152
  sun, 152
Linear ulcers of cords, 241
Liston, 150
Local anæsthesia, 243
Loss of smell, 183
Lowenberg's post-nasal forceps, 232
Lozenges, 258, 259
    compound chlorate of potash, 259
Lunar caustic, 242
Lupus, 223
Luschka, 168
  tonsil, 230

MACKENZIE, 152, 154, 246
  Mackenzie's light-concentrator, 152
    laryngeal electrode, 252
    forceps, 246
Malignant tumors, 245
  treatment, 245
Management of epiglottis, 160
  illumination, 153
  laryngeal mirror, 157
  reflector, 152
  tongue, 157
Meatuses of nose, 166
Membrane, Schneiderian, 173
Menstruation, vicarious, 205

- Mercury, acid nitrate of, 210, 221, 242
- Method of making topical applications, 180, 218, 235
  - of plugging nasal cavity, 206
- Middle ear in nasal catarrh, 183, 192
  - turbinated body, cleavage of, 201
- Miller's asthma, 204
  - cold, 204
- Mirror, laryngeal, 151
  - reflecting, 150
  - rhinoscopic, 167
- Morphia, 257
- Mouth-breathing, cause of chronic laryngitis, 183
  - pernicious effects of, 182
- Mucous glands, 174
  - membrane, cleansing of, 180
    - normal color, 162
    - of nasal cavities, 180
    - pathology of, 173, 177
  - patch, 220
  - polypi, 200, 207
- Myxoma, 200, 207

- NARES, anterior, 163
  - posterior, 163
    - examination of, 166
- Nasal carcinoma, 209
  - catarrh, atrophic, 196
    - hypertrophic, 182
    - simple chronic, 179
    - syphilitic, 210
  - cavities, anatomy of, 166, 169
    - disease of, 177
    - effect upon, of inspired air, 173
    - epithelium of, 174
    - erectile tissue of, 174
    - glands of, 174
    - mucous membrane of, 174
    - olfactory region of, 173
    - osmosis and exosmosis in, 174
    - physiology of, 173
    - plugging, method of, 206
    - respiratory region, 173
    - tumors of, 207
- Nasal curette, 203
  - duct, obstructions of, 183
  - dilators, 163
  - douche, 180
  - gouge and chisel, 194
  - gumma, 210, 212
  - hemorrhage, 205
  - hypertrophies, 182
    - anterior, 182, 188
    - pathology of, 200
    - posterior, 182, 189
  - obstruction, cause of chronic laryngitis and pharyngitis, 183
  - polypi, 200, 207
  - plug, 213
  - saw, 195
  - secretions, 166
    - effects of inflammation upon, 175
  - specula, 164, 166
  - stenosis, cause of catarrh, 213
  - post-nasal spaces, 163
  - syphilis, 210
- Naso-pharynx, 230
  - disease of, 230
- Necrosing ethmoiditis, 200
  - ætiology, 200
  - pathology, 200
  - prognosis, 203
  - symptoms, 200
  - treatment, 203
- Necrosis of laryngeal cartilages, 241
  - turbinated bones, 200
  - vomer, 211
- Neoplasms, laryngeal, 245
  - nasal, 207
- Nitrate of silver, 198, 256
  - solution, 226
  - therapeutics, 226
- Nitric acid, 185
- Nose bleeding, 205
  - olfactory portion of, 173
  - reddened from catarrh, 200
  - respiratory portion of, 173

- OBSERVER, 156
  - obstacles to laryngoscopy presented by, 159
- Obstacles to laryngoscopy, 159
  - on part of observer, 159

- Obstacles on part of patient, 159
  - to posterior rhinoscopy, 167
- Œdema, of glottis, 238, 247
  - of larynx, 338
    - ætiology, 239
    - symptoms, 239
    - treatment, 240
- Offensive breath in atrophic catarrh, 196
  - peculiar in syphilitic ulceration, 211
- Olfactory bulbs, 173
  - region of nasal cavity, 173
  - slit, 166, 183
- Optical principles of laryngoscopy, 156
- Osmosis, cause of pain, 255
  - in nasal cavity, 174
- Osteoma, 192, 223
- Ozæna, 199, 211

- PAPILLOMA, 207
  - laryngeal, 245
  - nasal, 207
  - pharyngeal, 223
- Paralysis of muscles of vocalization, 247
  - causes, 247
  - hysterical, 248
  - prognosis, 252
  - treatment, 252
  - unilateral, 249, 251
  - of the pharyngeal muscles, 216, 223
    - ætiology, 223
    - pathology, 223
    - symptoms, 223
    - treatment, 224
- Patch, mucous, 220
- Pathology of coryza, 176
  - hypertrophies, 182
  - mucous membranes, 173
  - polypi, 200, 207
- Patients, examination of, 172
- Peach cold, 204
- Pendant epiglottis, 160
- Perforation of septum, 210, 215
- Perichondritis, 210, 241
- Pharyngeal cutting forceps, 232
  - tonsil, 169
    - ablation of, 232
    - hypertrophy of, 230
- Pharyngitis, acute, 216, 217
  - mistaken for diphtheria, 226
  - chronic, 216
  - follicular, 218
  - glandular, 218
  - membranous, 216
  - sicca, 198
  - syphilitic, 216, 220
  - traumatic, 224
- Pharynx, adenoid tissue of, 230
  - diseases of, 216
  - inspection, 173
  - paralysis of the, 223
  - vault of, 167, 230
- Phthisical laryngitis, 243
  - pyriform swelling of arytenoid cartilages in, 243
- Pillars, adhesion of anterior, 227
  - inspection of, 173
- Pilocarpin, 240
- Plugging nose, method of, 206
- Polypi, 200, 207
  - cystic, 208
  - pathology, 200
  - symptoms, 207
  - treatment, 202, 208
- Position of patient and observer, 156
  - in laryngoscopy, 153
- Posterior hypertrophy, 182, 189
  - pathology, 182
  - treatment, 189
  - nares, 163
    - examinations of, 166
  - nasal chamber, 163
    - forceps, 232
  - rhinoscopy, 166
    - obstacles to, 167
- Post-nasal syringe, 230
- Potash, bromide of, 258
  - chlorate of, 258
  - iodide of, 258
- Production of catarrhal ulcers, 197
- Prognosis of aphonia, 252
  - atrophic catarrh, 199
  - hay cold, 215
  - paralysis of cords, 252
  - simple chronic rhinitis, 182
- Purgatives, saline, 179
- Pyriform swelling of arytenoid cartilages, 243

QUINSY, 217, 225

REFLECTION, law of, 156
Reflector, 149, 151, 152
  attached to jointed arm, 153
  concave, 151
  plane, 152
  position of, 152
  supported on head, 152
Relaxed throat, 218
Reservoir insufflator, 172
Respiratory portion of nose, 173
Rhinitis, acute, 178
  atrophic, 196
  hypertrophic, 182
  simple chronic, 179
  syphilitic, 210
Rhinoliths, 216
Rhinology, definition of, 163
Rhinorrhagia, 205
  ætiology, 205
  pathology, 205
  treatment, 206
Rhinoscopic image, 167
  mirror, 167
Rhinoscopy, 163
  anterior, 163
  posterior, 166, 169
    introduction of mirror in, 167
    obstacles to, 167
Rima glottidis, 161
Rose cold, 204

SALINE purgatives, 178
Santorini, cartilages of, 162
Sarcoma, nasal, 208
  prognosis, 209
  treatment, 209
  pharyngeal, 223
Sass' atomizing tubes, 169
Saw, nasal, 195
Scabs, 197
Scarification of larynx, 240
Schneiderian membrane, 173
Scirrhus tonsil, 227, 228
Scrofulous catarrh, 196
Secretions, inspissated, how removed, *198*
Secretions of mucous membrane altered by disease, 175
  retention in nasal cavity, 182
Seiler, antiseptic solution, 254
  galvano-cautery handle, 189
  guillotine and tube forceps, 224
  nasal gouges and chisel, 194
Selligue, 150
Septal nerves, 183, 212
Septum, bony ridge on, 182, 192
  deviation of, 166, 169
  exostoses of, 182, 191
  knife, 214
  perforation of, 215
  thickening, 182
Silver, nitrate of, 198, 256
Simple chronic pharyngitis, 218
    treatment of, 218
  rhinitis, 179
    ætiology, 180
    pathology, 180
    symptoms, 180
    treatment, 180
Simulated hæmoptysis, 206
Sinus, frontal, 183
Slit, olfactory, 166
Smell, loss of, 183
Snoring in hypertrophied tonsils, 227
Snow cold, 204
Solution, antiseptic, 254
  Dobell's, 254
  of iodine, 181, 256
  of nitrate of silver, 198, 256
Sore throat, 217, 218
  clergyman's, 218
Sound, laryngeal, 169
Source of light, 152
Space, inter-arytenoid, 161
  post-nasal, 163
Speakers' sore throat, 218
Specific chronic pharyngitis, 220
    symptoms, 220
    treatment, 221
  rhinitis, 210
Speculæ, nasal, 164, 166
Stenosis of larynx, 242
  nasal cavity, 213
Strychnine, 252
Styptics, use of, in nose, 205
Subacute laryngitis, 236
Submucous infiltration of the septum, 215

- Submucous treatment, 215
- Sulphate of copper, 230
- Summer catarrh, 204
- Sunlight, 152
- Surgical treatment of hypertrophic catarrh, 183
- Symmetry in syphilitic inflammations, 221
- Symptoms of acute laryngitis, 234
    - pharyngitis, 217
  - atrophic catarrh, 192
  - chronic laryngitis, 237
    - pharyngitis, 218
  - coryza, 178
  - elongated uvula, 229
  - hay fever, 204
  - hypertrophic catarrh, 182
    - tonsils, 227
  - laryngeal neoplasms, 245
  - laryngitis, phthisical, 243
  - œdema of larynx, 238
  - paralysis of cords, 247
  - subacute laryngitis, 236
  - syphilitic laryngitis, 241
- Syphilitic catarrh, 210
    - treatment, 211
  - laryngitis, 241
    - prognosis, 241
    - symptoms, 241
    - treatment, 241
  - pharyngitis, 220
  - rhinitis, 210
    - pathology, 210
    - treatment, 210
  - ulcers, 221
- Syphiloma, 210, 221, 241
- Syringe, post-nasal, 230
- Systematic examination, 172

- TANNIC acid, 257
- Taste, loss of the sense of, 183
- Thickening of vocal cords, 239
- Thudichum's douche, 180
- Thyro-arytenoid muscles, 252
- Tincture of benzoin, 235, 236, 238
  - iron, 256
- Tobold, 152
- Tongue depressor, 160
    - Cohen's, 160
    - folding, 160
  - management of, 157
- Tonsillitis, acute, 217, 225
- Tonsillotome, 228
- Tonsils, altered secretion of, mistaken for diphtheria, 226
  - amputation of, 228
  - hypertrophied, 227
  - in pharyngitis, 217
  - inspection of, 173
  - pharyngeal, 230
- Topical applications, method of making, 180, 219, 235
    - nose, 180
    - pharynx, 219
    - larynx, 235
- Tracheotomy, 240, 247
- Traumatic acute laryngitis, 234
  - inflammation of mucous membrane, 174
- Treatment of acute laryngitis, 234
    - pharyngitis, 217
  - atrophic catarrh, 192
  - bony obstructions of nose, 193
  - chronic laryngitis, 237
    - pharyngitis, 218
      - follicular, 218
      - granular, 218
  - coryza, 178
  - elongated uvula, 229
  - hay fever, 204
  - hypertrophic catarrh, 182
    - tonsils, 227
  - laryngeal neoplasms, 245
  - laryngitis phthisica, 243
  - œdema, 238
  - paralysis, 252
  - stenosis of larynx from cicatrizations, 242
  - subacute laryngitis, 236
  - syphilitic laryngitis, 241
    - pharyngitis, 221
  - tumors of nasal cavities, 208, 209
- Tube-forceps, 224

Tubercles in larynx, 244
Tubes, Eustachian, 169, 183
Tumors, classification of, 245
  laryngeal, 245
  of nasal cavity, 207
    cystic, 207, 208
    fibrous, 207
    mucous, 207
      ætiology, 208
      pathology, 207
      symptoms, 207
      treatment, 208
  pharyngeal, 223
Turbinated bones, 166, 169
  atrophy of, 197
  hypertrophy of, 182
Türck, 151

ULCERS, 197, 241, 244, 245
  carcinomatous, 245
  catarrhal production of, 197
  linear, of cords, 244
  syphilitic, 241
Unilateral paralysis of larynx, 249
  pharynx, 223
Universal tube-forceps, Seiler's, 224
Use of nasal douche, 180
Uvula, amputation of, 229
  elongated, 229
    ætiology, 229
    symptoms, 229
    treatment, 229
  inspection of, 173

VAPOR inhalations, 170, 260
Variations in color of normal mucous membrane, 162
Vascular growths, 208
Vaso-motor coryza, 204
  ætiology, 205
  prognosis, 205
  symptoms, 204
  treatment, 204
Vault of pharynx, 167
Veeder's lamp, 153
Velum palati, method of controlling, 167
  obstacles to posterior rhinoscopy, 167
Ventricular bands, 161
Vestibule of nose, 166
Vibrissæ, 166
Vicarious menstruation, 205
Vocal cords, 161
  hyperplasia of, 235
  paralysis of, 247
  ulcerations of, 241, 243
Vocalization, laryngeal image in, 162
  painful, 237
  paralysis of muscles of, 247
Voice, faulty productions of, 236
  nasal, 173
Vomer, 182
  exostoses of, 182, 191
  necrosis of, 210

WARDEN, 150
Watson, 188
Wire loop, 185
Wrisberg, cartilages of, 162

ZINC sulphate, 235, 238, 257

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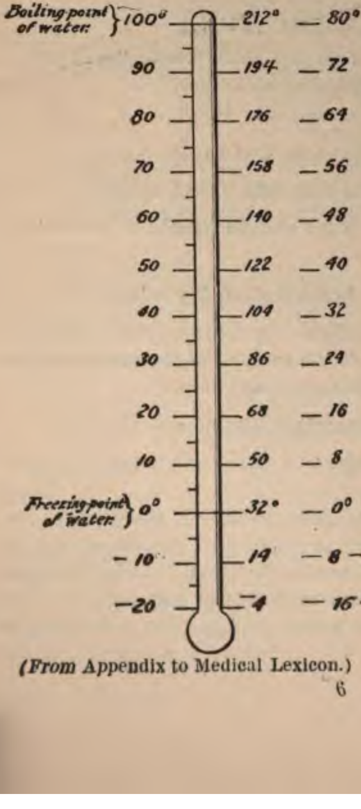

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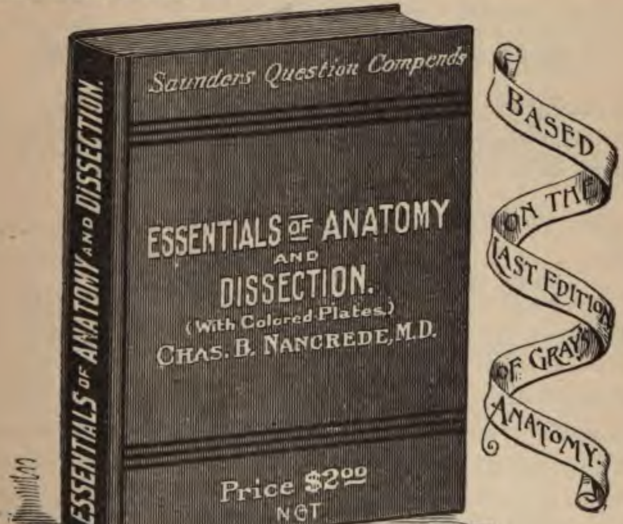
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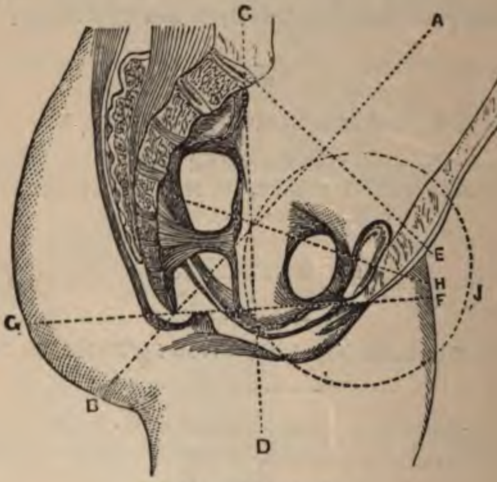

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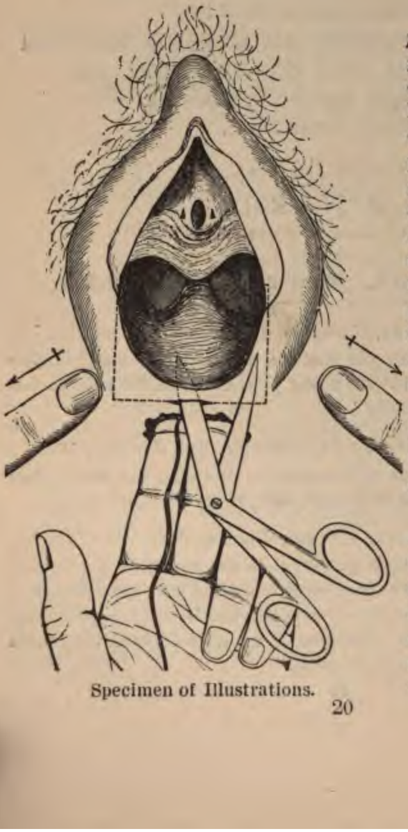

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INDEX.

PAGE
ANNOUNCEMENT 1
AMERICAN TEXT-BOOK OF SURGERY 2, 3
VIERORDT AND STUART'S MEDICAL DIAGNOSIS . . 4
KEATING'S NEW UNABRIDGED DICTIONARY OF MEDICINE 5
SAUNDERS' POCKET MEDICAL LEXICON 6
NANCREDE'S ANATOMY AND MANUAL OF DISSECTION . 7
DESCHWEINITZ'S DISEASES OF THE EYE 8
GARRIGUE'S DISEASES OF WOMEN 9
NORRIS' SYLLABUS OF OBSTETRICAL LECTURES . . 9
SAUNDERS' POCKET MEDICAL FORMULARY . . . 10
SAUNDERS' SERIES OF QUESTION COMPENDS . . . 11
HARE'S PHYSIOLOGY 12
MARTIN'S SURGERY 13
NANCREDE'S ANATOMY 14
WOLFF'S CHEMISTRY 15
ASHTON'S OBSTETRICS 16
SEMPLE'S PATHOLOGY, ETC. 17
MORRIS' MATERIA MEDICA 18
MORRIS' PRACTICE OF MEDICINE 19
CRAGIN'S GYNÆCOLOGY 20
STELWAGEN'S DISEASES OF THE SKIN 21
MARTIN'S MINOR SURGERY, ETC. 22
SEMPLE'S LEGAL MEDICINE, ETC. 23
JACKSON AND GLEASON'S DISEASES OF EYE, NOSE, AND THROAT 24
POWELL'S DISEASES OF CHILDREN 25
WOLFF'S EXAMINATION OF URINE 26
SAYRE'S PRACTICE OF PHARMACY 27
WORKS IN PREPARATION AND IN PRESS 28
MARTIN AND HARE'S WOUNDS AND OBSTRUCTION OF THE INTESTINES 29

SAUNDERS' QUESTION-COMPENDS.

OPINIONS OF THE PRESS.

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